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# MANAGEMENT OF BILIARY TRACT DISEASE*

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IT is now recognized that the management of biliary tract disease, like the management of almost all other intra-abdominal disease, has become a joint problem of surgeon and internist. While the treatment of gall-bladder infection and stones, and of cholangitis, is admittedly surgical, the diagnosis and the postoperative treatment of these conditions present problems of great interest to the internist.

Cholecystography, with its information concerning the function of the gall bladder, and also the estimations of bilirubin, have furnished valuable contributions toward the diagnosis of disease of the biliary tract which was once dependent upon symptomatology and obvious evidence of obstruction, such as icterus, acholic stools, bile in the urine, and the presence of abnormal contents in the bile obtained by medical drainage. These two contributions have not only added diagnostic criteria of great value to the equipment of the internist, but they have also played a part in the increase of his responsibility for the prevention of two undesirable conditions in the management of biliary tract disease.

These two undesirable conditions, which have occurred with considerable frequency in the past, are (1) surgery upon the gall bladder where it is not definitely needed; and (2) delay in surgery where gallstones or gall-bladder infection are present. Careful interpretation of all the diagnostic data now available should reduce the incidence of both these conditions to a minimum.

In our experience, unnecessary surgery for gall-bladder disease has resulted most frequently from failure to differentiate (1) malignant disease of the pancreas, and (2) functional disease of the colon: the former condition because of its symptoms due to obstruction of the biliary tract, and the latter for two reasons: (1) because the pain and distress which sometimes accompany functional disease of the colon simulates that of gall-bladder disease; and (2) because colonic irritability or instability is sometimes attended by a failure of the gall bladder to fill with the Graham test. The resulting positive test is used as evidence indicating the presence of gall-bladder disease, and makes surgery seem indicated. It has become our custom, therefore, in all cases where there is no obvious evidence of biliary tract obstruction or of actual stones, and where a barium enema and the history give evidence of colonic irritability, to use a positive Graham test only as preliminary evidence, to be confirmed or rejected by a later test, after the colonic irritability has been treated. In 44 per cent in a series of 65 such cases recently studied, the gall bladder filled normally after five to ten days of bowel management; whereas, with the same intravenous technique, it had previously shown an absence of filling or an inadequate filling. Chiray and Lomon* have recently described dystony and dyskinesia of the gall bladder as evidenced by its

* *Arch. d. mal. de l'app. digestif.*, 20: p. 5, 1930.

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size and shape with cholecystography, and it is our opinion that the abnormality just described is due also to an abnormality of tone of the gall bladder associated with abnormal tone in the muscle of the colon. In the days before cholecystography, and even before it was found that the positive Graham test in the presence of an irritable colon, needs confirmation after the colon has been treated, cholecystectomy was done, and in our hands in a definite group of cases chronic cholecystitis diagnosed; but the symptoms were relieved only when treatment for the colon was also given.

The second undesirable condition which the internist has the greatest opportunity to prevent is delay in surgery, where gallstones or infection in the gall bladder or biliary ducts have been demonstrated; and the fact that mortality in gall-bladder disease is directly proportionate to the complicating factors involved in cholangitis, obstruction, and acute cholecystitis, together with the further fact that these conditions are so often the result of gallstones, make it desirable to remove gall bladders with stones as soon as they are discovered. Cholecystography has been of great value in the identification of both the cholesterol and bilirubin calcium stone. The so-called harmless or silent stones which have been brought to light by this method of diagnosis must be publicly denounced if we are to prevent the harmful sequelae of cholelithiasis.

In a follow-up report of our series of patients upon whom we have done biliary tract operations, Dr. R. B. Cattell of this Clinic has reported that the poorest results are in those patients operated with the diagnosis of chronic cholecystitis. This is a diagnosis which should be made with the same infrequency and with the same caution as is the diagnosis of chronic appendicitis. Both conditions exist, both are benefited by surgery when they do exist; but both are diagnosed and operations done for them much oftener when they do not exist than when they do.

To protect ourselves as much as possible against operative error in this condition, we have said that surgery shall be advised for chronic cholecystitis only under the following conditions: when the pain or discomfort is of sufficient magnitude to justify surgery; when all other conditions as a possible cause of the distress have been ruled out; when medical measures have failed to relieve the patient of the discomfort; and when cholecystogram shows at least suspicious evidence of gall-bladder pathology. With those criteria fulfilled, especially the one that discomfort be sufficiently great to justify surgery, cholecystectomy will then yield good results in this indefinite, intangible, and often wrongly diagnosed condition.

The following figures illustrate our position as to cholecystectomy as opposed to cholecystostomy. From 1910 to 1926, 65 cholecystostomies were done, in 635 operated cases, and out of these 65 cases, only 62 per cent were relieved over a period of a year or longer. From 1927 to 1929, only 8 cholecystostomies out of 413 biliary tract operations were done.

Acute cholecystitis has interested us very much in that, in the end-result studies of our operated cases, it has been definitely demonstrated to be one of the mortality-producing factors. As the result of our experience with these cases, we believe that it is desirable to delay surgery in acutely inflamed gall bladders as long as it is evident that the acute process is not progressing, in order to be able to do a deliberate and safe cholecystectomy upon a gall bladder not harboring an acute infection. If the acute process is quieting down, we continue to delay operation, if possible, until it is probable that most of the infection and induration of the gall bladder have subsided. If, however, the acute process does not progressively subside, and operation must be done in the presence of acute or subacute infection and induration, we feel strongly that in many cases the gall bladder should be drained until the acute process has sub-

sided, and cholecystectomy done at a second operation. We know from our own personal experience that it is here out of sentiment that one sometimes unwisely removes a gall bladder in one stage to save the patient a second operation, when preliminary drainage and later cholecystectomy would have lessened the chances of a fatality.

We have now operated upon 1110 patients having biliary tract disease. Up to 1926, the mortality was 5.4 per cent, and from 1926 to date the mortality is 2.2 per cent in 413 cases. We know that exclusive of hemorrhage, wound rupture, emboli and pneumonia, at least partly uncontrollable factors, a considerable part of the mortality of biliary tract surgery is the result of complications due to delay, and that the situation today in the surgery of biliary tract disease is very similar to that in which prostatic surgery was some years ago. Just as we know that the mortality of prostatic surgery is related largely to kidney function and the late effects of infection and obstruction on it, so we know in the same way that the mortality of biliary tract surgery is related to the liver and the late effects of infection and back pressure upon it.

It is in the patients who have been permitted to pass through repeated attacks of gallstone colic that we find the common duct stones, the pancreatitis and the cholangitis, the mortality-producing factors in the surgery of cholelithiasis and infection of the biliary tract. If we could limit our biliary tract surgery to those patients who have passed through but one or two attacks of biliary colic, or to those patients whose stones and infection were limited to the gall bladder, we believe that we could maintain an even lower mortality rate than we have had for the past few years.

We are strongly of the opinion that gall stones should be operated upon as soon as they are diagnosed and the general situation permits, just as with appendicitis. It is in our opinion wrong to permit patients to pass through repeated attacks of biliary colic without firmly advocating surgery, and placing the responsibility for delay directly upon patients and their families. We are also of the opinion that there are no harmless gallstones, and that those gallstones found in the course of routine gastrointestinal examinations should be removed.

We have been very much interested in the incidence of common duct stones in our cases, and based upon our own experience we believe that a great many patients have common duct stones left in their ducts following cholecystectomy.

In the 634 patients having biliary tract disease upon whom we had operated up to 1926, the common duct was opened and explored in 96 or 15.1 per cent, and common duct stones were discovered in 52 or 8.2 per cent. In the 413 biliary tract cases of patients operated on since 1926, the common duct has been explored in 143 or 34.6 per cent of the cases, and stones have been discovered in 67 or 16.2 per cent of the cases.

By doubling the percentage of exploration of the common duct, we have doubled the percentage of discovery of common duct stones.

We know that common duct stones can and do exist as often if not oftener without jaundice or a history of jaundice, as they do with that typical evidence of their presence. We know that they are not infrequently present in the very lowest end of the common duct at the ampulla of Vater without marked dilatation or thickening of the common duct, and often without being definitely palpable because the lower end of the duct is surrounded by the head of the pancreas. We know furthermore from our own experience with these cases, that when a patient is operated upon for gallstones, and following the operation has a return of the same type of pain which he had before he was operated upon, that this pain is rarely due to adhesions or a plug of mucus in the duct, as is often stated, but is most likely to be due to a stone in the common and hepatic

duct which we have overlooked at the time of the cholecystectomy.

Based upon our own experience, then, we would strongly urge that a much higher percentage of patients should have their common and hepatic ducts opened and explored at the time that cholecystectomy is done, and that increasing the percentage of cases in which the common and hepatic ducts are opened and explored for stones and infection at the time of the cholecystectomy will, in experienced hands, lower and not elevate the immediate and remote mortality of biliary tract surgery.

Patients with painless jaundice present a problem which often severely taxes the combined diagnostic resources of the surgeon and gastroenterologist.

There is nothing more depressing in surgery than to have submitted to exploration the utterly hopeless and pitiable person for whom nothing, even in a palliative way, can be done. Yet many patients with carcinoma of the head of the pancreas and dilatation of the gall bladder can, by anastomosis of their gall bladder to their stomach, duodenum or jejunum, be given such comfort and prolongation of life over such a considerable period of time that the operation when applied in proper cases is well worth doing, and one which is justifiable even in the face of considerable risk.

Courvoisier's law has proved of real value to us in arriving at decision for or against operation, particularly in those patients with painless and progressive jaundice in whom the question of exploration or relief from jaundice comes up. Courvoisier's law is, in the presence of jaundice a dilated gall bladder is indicative that the biliary obstruction is due to cancer, while a contracted gall bladder is indicative that the obstruction is due to stone. Without going into the defects and modifications of the law, which we have discussed elsewhere in other articles on this subject, we believe that rarely will operation prove of any value in painless progressive jaundice with persistently acholic stools, except when the gall bladder is dilated and palpable. When it is dilated and palpable, it is evident then (1) that the probably malignant obstruction is below the part where the cystic duct enters the common; and (2) the gall bladder wall is still normal enough to stretch and dilate, and so lends itself to anastomosis to the intestinal canal. When, therefore, the gall bladder is not dilated and palpable in painless and progressive jaundice in a patient with persistently acholic stools, exploratory operation will only shorten the days and increase the suffering of the patient, and burden the conscience of the surgeon who performs it.

In conclusion, it must be realized that the surgical treatment of gall bladder disease, cholecystectomy, and in many cases choledochostomy, may be all that is required to produce complete relief of symptoms. On the other hand, many of the symptoms of chronic cholecystitis, distension, gaseous eructations, and distress, are due apparently not to the dysfunction of the gall bladder primarily, but to an associated gastric or colonic malfunction. Achlorhydria and colonic irritability must often be treated in conjunction with cholecystectomy before relief of symptoms occurs. For this reason, as well as for completeness of diagnosis, the surgeon requires the aid of the gastroenterologist in the treatment of biliary tract disease, and in all cases a thorough gastrointestinal study should be made even though the first film shows gallstones and the symptoms are thought to be clearly due to this cause.

## DISCUSSION

Dr. Lyon: This paper is a good example of what can be done by effective team-work between a capable surgeon and a skillful internist. As shown by Dr. Lahey, a reduction of operative mortality has been brought about by a more careful selection of patients for whom surgery is definitely required after a suitable period devoted to a more careful preoperative study of such patients; secondly, the mortality has been reduced by more

extensive preoperative preparation of the patient by the internist, a gentle surgical hand, and a conservative surgical attitude in not attempting to do more than the patient can withstand with especial care to reduce liver shock. After operation such patients are and should be returned to the internist for proper postoperative medical treatment. In addition to a suitable follow-up diet, and careful instructions to the patient as to how he must conduct his living for a full year thereafter, we can best accomplish a reduction in post-operative morbidity by duodenal tube drainage of the liver, extrahepatic ducts and pancreas. Such drainage, microscopy and bacteriology not only recognize the presence of states of cholangitis but, also, materially assist in improving the state of hepatitis which so frequently accompanies gall-bladder disease.

The second point I want to emphasize is to recall to your memory a paper which Dr. Swalm and I reported in 1927 on "Obstruction of the Cystic Duct of a Catarrhal Variety," a by no means uncommon condition. In such patients there is an inherent error of diagnosis by the Graham cholecystogram unless cross-checked by a duodenal drainage study, because in the cystic duct blocked with catarrh the dye does not enter or visualize the gall bladder. It is therefore, too frequently interpreted as a pathological gall bladder whereas in many cases the gall bladder is not actually diseased. The correct diagnosis can be established by the duodenal tube and microscope, as reported. Many such cholecystograms interpreted as gall-bladder disease can be restored by duodenal tube drainage to a state of normal cholecystographic function. Cystic duct catarrh is somewhat analogous to common duct catarrh or catarrh of the intrahepatic biliary tree, except for its location and for the fact that it does not necessarily, of itself, produce jaundice. Therefore, many such patients can be restored to health without surgery.

The third point I wish to stress is in connection with the greater frequency than is commonly recognized of the existence of multiple lesions in chronic intraabdominal disease. In very many patients with gall-bladder disease, on careful survey there will be found duodenitis or duodenal ulcer, an abnormal appendix (if not previously removed) and a a functional disturbance, if not organic disease of the intestines, most notably sigmoid colitis. I believe this happens so frequently that we should cease to speak in diagnostic terms of cholecystitis or duodenal ulcer as single entities and in our pre-survey always consider the case of cholecystitis plus what ? or duodenal ulcer plus what? Failure to recognize this fact is the commonest cause for operation and re-operation.

Finally, I have found that many patients of advanced years with chronic calculous cholecystitis are essentially poor operative risks, and for these general medical management, with special reliance on duodenal tube management, is preferable to surgery, except in patients whose strength and morale are being worn down by repeated attacks of biliary colic. After ten years' experience with this group I can show a large number of patients, who although possessing gallstones and a functionless gall bladder, have been maintained in good health. Their condition is quite as good as if they had been successfully operated upon, and certainly better than those cases with bad myocardiums and depreciated kidney function plus injudicious surgical enthusiasm. Too many such patients are now six feet under the sod instead of possessing a reasonable degree of health.

Dr. Alvarez: I think these papers prove, if we need any proof, that it is a wonderful thing for us to have someone outside of our group give us a "new slant" on our specialty. I agree with Dr. Lahey that it is better to have a patient cured of his ulcer but still needing a cholecystectomy than a patient cured of both ulcer and cholecystitis—but dead!

# ORAL CHOLECYSTOGRAPHY

## IN THE DIAGNOSIS OF CHRONIC GALL-BLADDER DISEASE*

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THE diseased gall bladder may underlie so many variable symptoms referable to the abdomen, the chest, the head, and even the extremities that it is often a difficult task to untangle the maze of conflicting symptoms and place guilt where guilt belongs. Our most reliable aids in this task are: (1) a carefully taken and thoughtfully considered history, (2) a complete physical exanination, (3) clinical laboratory studies and (4) roentgenologic examinations of the gall bladder and intestinal tract. This paper will deal chiefly with the last named aid, roentgenologic examination.

### SYMPTOMATOLOGY

While the ancient dictum of the probability of gall bladder disease in the patient who is "fair, fat, forty, full of flatus" and complaining of upper abdominal pain, is still a quite reliable guide, other symptoms should direct our suspicion to this organ. Among the more prominent of these are headache, constipation and chronic arthritis. Precordial pain simulating angina pectoris, even in radiation down the left arm, may occur. L. W. Grove[11] has operated upon several patients whose symptoms were almost classic of angina, but removal of a calculous gall bladder resulted in complete relief.

A study of the symptomatology in 30 operated cases in our series gave the following results:

Females 21 cases; males 9.

Average age: females 42; males 45.

Duration of symptoms: average six and one-half years; varied from six months to thirty years.

Pain: upper abdominal 17 cases; right lower quadrant 4 cases; right flank 2 cases; generalized abdominal pain 5 cases; and no pain complained of in 1 case.

Indigestion; 28 cases.
Sour stomach: 14 cases.
Gas: 27 cases.
Belching: 27 cases.
Nausea or vomiting or both: 19 cases.
Heart burn: 5 cases.
Palpitation: 4 cases.
Constipation: 25 cases.
Clay stools: 6 cases.
Tarry stools: 1 case.
Jaundice: 13 cases.
Headache: 11 cases.
Joint pains: 7 cases

Type of foods causing distress: all foods, 6 cases; greasy foods, 4 cases; sweets, 1 case; fruit juices, 1 case; and in 18 cases no particular type of food was mentioned.

It is easily seen that the complaints of indigestion, gas, belching and constipation predominated in this small series. Next in order of frequency were nausea, sour stomach, jaundice and headache. It is notable that 7 of the 30 patients complained of joint pains.

### DIFFERENTIAL DIAGNOSIS

In their recent book[1] Graham, Cole, Copher and Moore list the following conditions which may be clinically confused with chronic cholecystitis: lesions of the stomach and duodenum; spastic constipation; intestinal allergy; carcinoma of the hepatic flexure; chronic appendicitis; cirrhosis of the liver; syphilis of the liver; lesions of the kidney; hemolytic icterus; spinal lesions, such as Pott's disease; chronic lesions of the right lung, such as pleurisy; slipping of the eleventh rib over the twelfth with resultant pain; and among the rarer causes, parasitic diseases of the gall bladder, such as echinococcus cysts and round worm infection.

* Read before The Chattahoochee Valley Medical and Surgical Association, Albany, Georgia, July 9, 1930.

### LABORATORY DIAGNOSIS

The chief value of laboratory studies lies in differentiation of the obstructive and hemolytic types of jaundice, by means of the Van Den Bergh reaction, red cell fragility tests, icterus index, examination of blood smears, determination of bilirubin content of the urine, etc. Leucocytosis is not a constant factor except in empyema of the gall bladder.

Analysis of the material obtained by magnesium sulphate drainage of the gall bladder is considered valuable by some, but my personal experience with this method as a diagnostic agent is so limited as to make any opinion expressed worthless.

### ROENTGENOLOGIC EXAMINATION OF THE GALL BLADDER

Roentgenologic examination of the gall bladder should consist of (1) preliminary flat films, (2) cholecystography and (3) barium meal examination of the stomach and duodenum where indicated.

On the flat films we may demonstrate opaque calculi; occasionally, the outline of an enlarged gall bladder, such as a hydropic gall bladder; and in some instances renal stones, spinal lesions, enlarged liver, or pancreatic calcification. Any confusing shadows may be better identified later if their presence is detected before employing cholecystography.

Cholecystography has been subjected to the unfair demands of the unduly critical and the exaggerated claims of the enthusiastic. If we consider the rationale of the procedure, we may learn how much and how little we should expect from it.

To understand cholecystography, it is

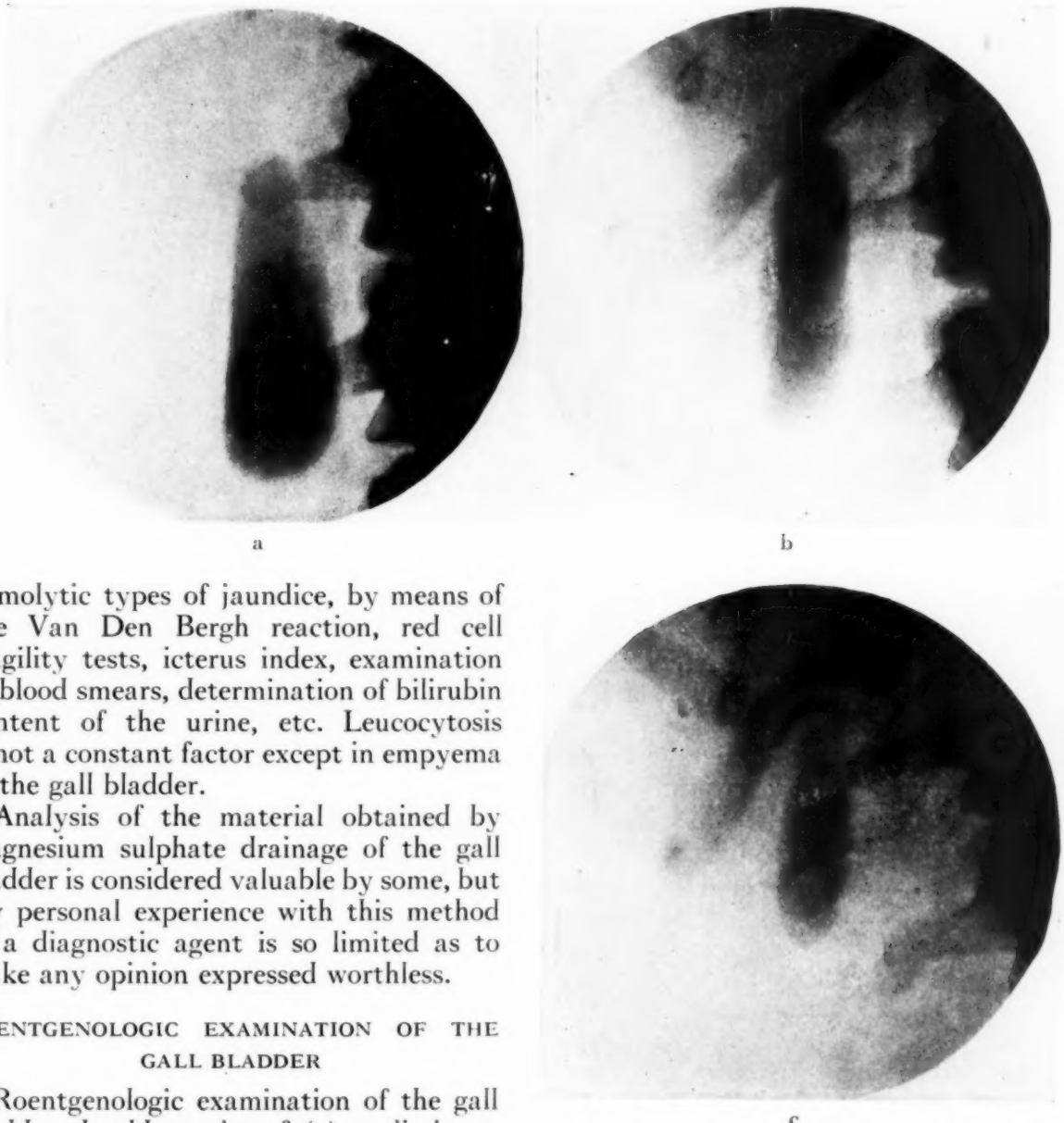

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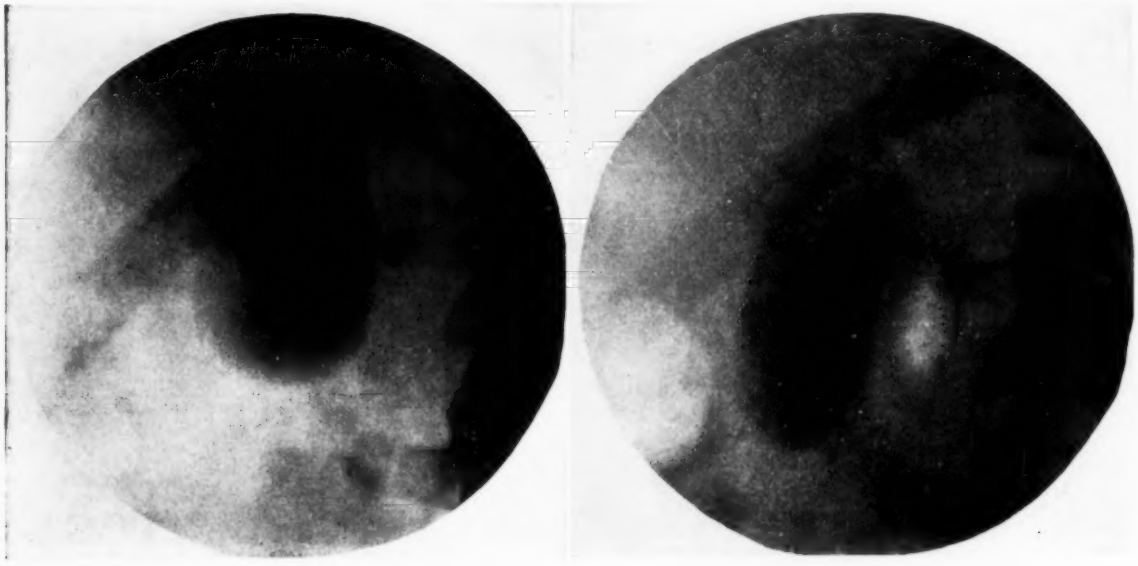
FIG. 1. Sthenic habitus. Normal gall bladder. (a) Twelve hours after taking dye orally. (b) Fourteen hours after dye. (c) Two hours after fatty meal. Note decrease in size of shadow and upward migration.

necessary to review briefly the physiology of the gall bladder. From the mass of clinical, anatomical, and laboratory investigations, which have been ably reviewed by Graham,[2] Alvarez,[5] and others, the following facts seem definitely established: (1) Bile is excreted by the liver and fills the gall bladder largely by way of the cystic duct. (2) The gall bladder concentrates bile. (3) At periodic intervals, and apparently in response to digestive activity, the gall bladder empties its contents into the common duct and thence into the duodenum. The chief components of the emptying act seem to be (1) contraction of the gall bladder wall and (2) washing out of the gall bladder by the recurring flow of liver bile.[3]

The theory of a contrary innervation of the sphincter of Odi and the gall bladder is as yet in the throes of dispute among the physiologists. Alvarez[6] states that there seems to be a connection but doubts the theory of contrary innervation, and thinks that the causes are chiefly chemical, as shown by the work of Boyden concerning the effect of egg yolk and fat on emptying of the gall bladder.

Cholecystography, or the Graham test, is primarily a test of gall bladder function, and is based on the physiologic factors. It consists in introducing into the circulation, either intravenously or via the intestinal tract, a halogenated pthalein containing iodine. Carried by the circulation to the liver, the dye is excreted in the bile and then obeys to some extent the physiological laws governing the con-



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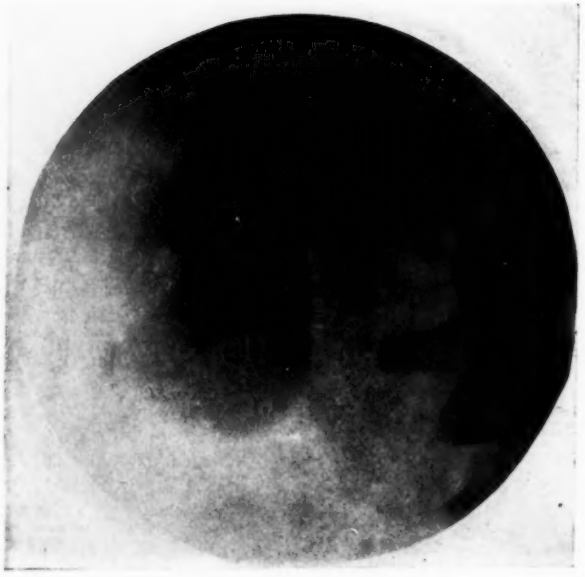

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Fig. 2. Hypersthenic habitus. Normal dye concentration but delayed emptying. (a) Fourteen hours after dye. Film made in expiration. (b) Fourteen hours after dye. Film made in inspiration. Note gall bladder shadow projected below rib. (c) Four hours after fatty meal. Slight decrease in density but no decrease in size of shadow.

centration and expulsion of bile by the gall bladder. It is thus obvious that the following requisites are necessary for obtaining a shadow of the gall bladder by cholecystography:

(1) Sufficient dye must enter the circulation.

(2) The liver must be able to excrete the dye into the bile.

(3) The cystic duct must be open.

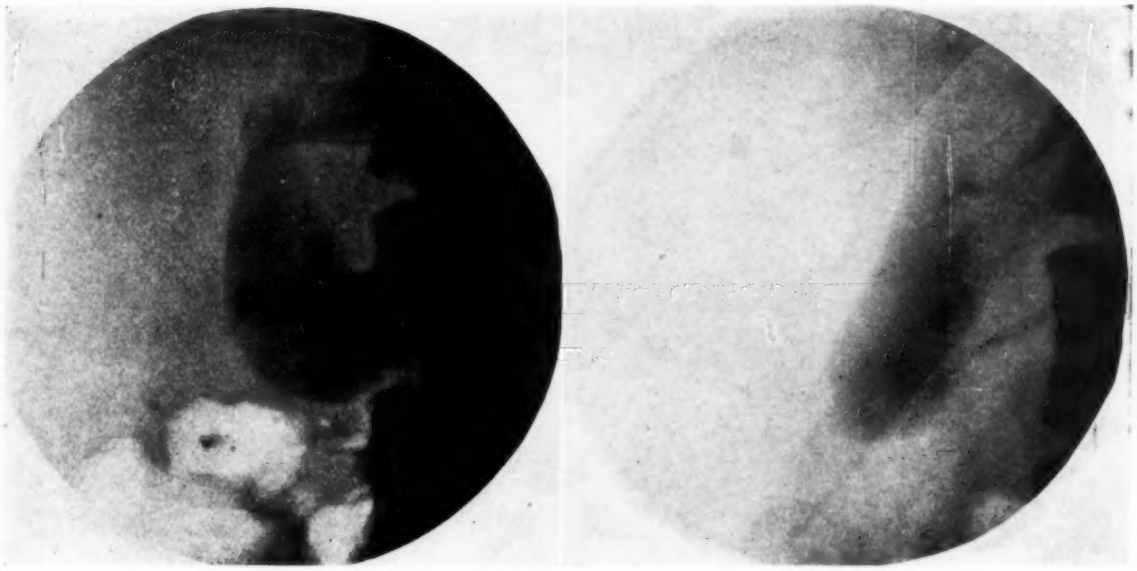

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Fig. 3. Asthenic habitus. Normal gall bladder. (a) Thirteen hours after dye. Note gall bladder shadow overlying transverse processes of spine. (b) Same. Lateral view used to project gall bladder clear of transverse processes.

(4) The gall bladder must be able to concentrate the dye to some degree.

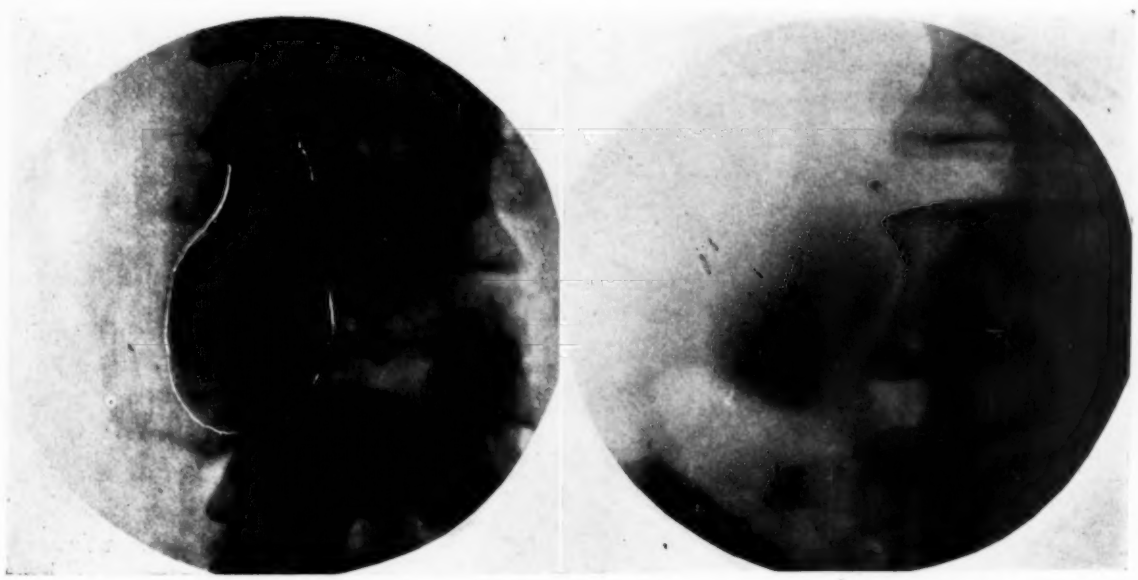

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Fig. 4. Asthenic habitus. Use of vertical oblique position to project gall bladder shadow away from spine. (a) Posteroanterior view, prone position. Note gall bladder shadow (retouched) overlying spine. (b) Vertical oblique view (Bucky technic) showing gall bladder clear of spine.

In interpreting cholecystograms we therefore note (1) the time required for

appearance of dye in the gall bladder; (2) the degree of dye concentration as noted by the density of the gall bladder by reason of their contrast with the more dense dye shadow.

In the oral method of cholecystography,

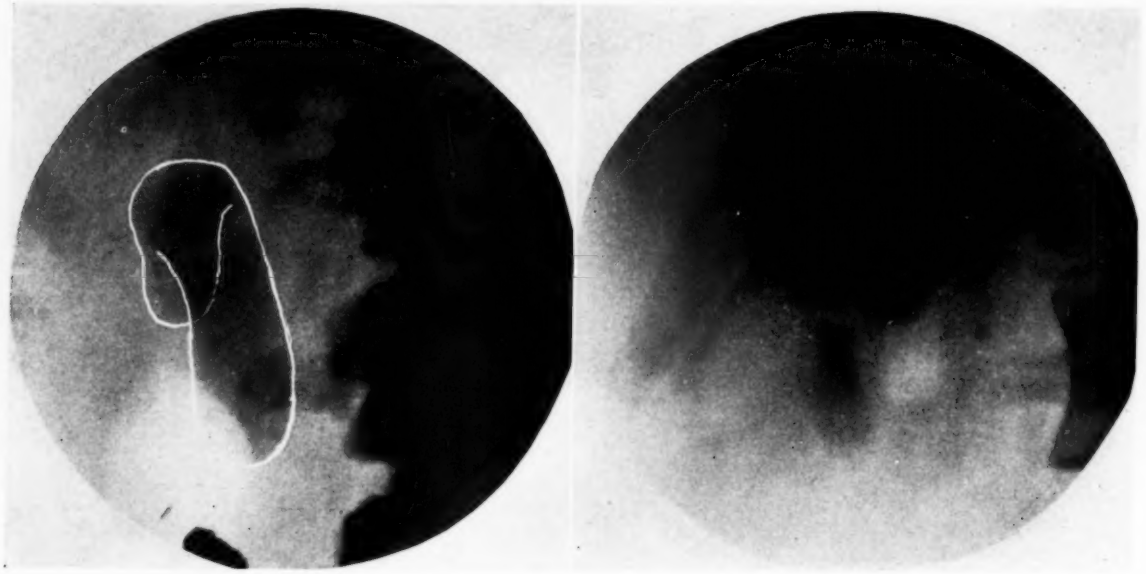

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FIG. 5. Two cases of extrinsic deformity of gall bladder. (a) Angulation at neck of gall bladder (retouched). (b) Similar angulation, and also an incisura in mid-portion of the organ.

shadow; (3) the time required for the gall bladder to empty the dye-stained bile in as used in the cases herein summarized, a gall bladder shadow of good intensity

a b

FIG. 6. Multiple cholesterol stones, 26 stones found at operation. (a) Fourteen hours after dye. Note multiple negative shadows. (b) Two hours after fatty meal. Note contracted gall bladder with negative shadows remaining within its outline. This excludes gas as cause of shadows.

response to a fatty meal and (4) whether or not cholesterol stones are demonstrated should be obtained in from twelve to sixteen hours after administration of the dye,

and the organ should be at least one-half empty two hours after a meal of egg yolk, butter and cream has been eaten.

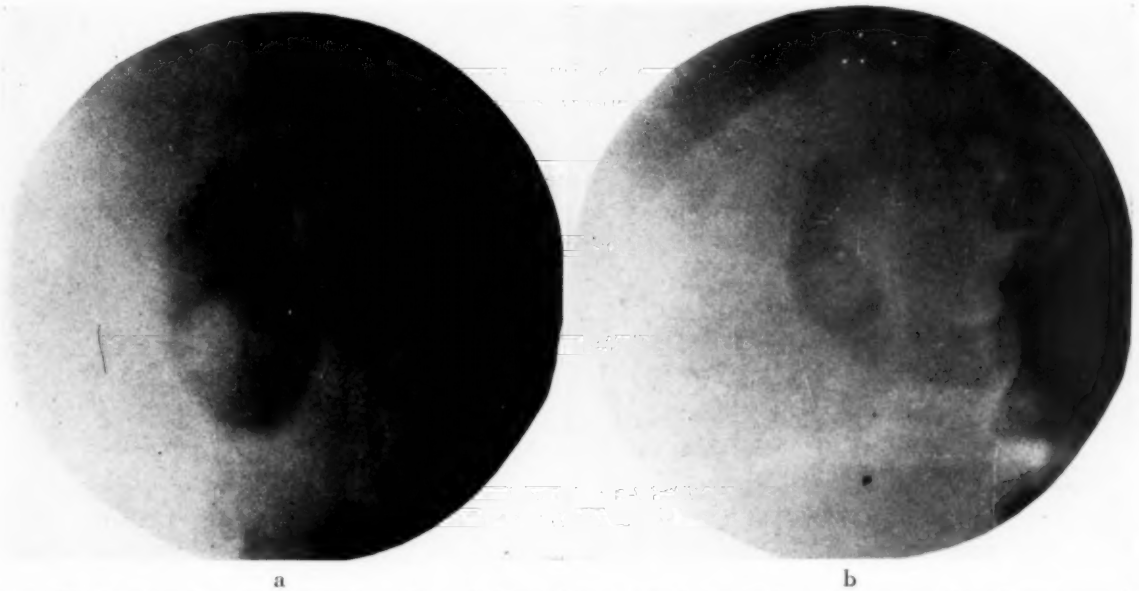

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Fig. 7. Single negative density defect. One cholesterol stone and "strawberry" mucosa found at operation. (a) Fourteen hours after dye. (b) Two hours after fatty meal. Note ring of dye surrounding stone shadow. Excellent function despite presence of stone and diseased mucosa.

As we are reminded by Alvarez, a diseased gall bladder may show a fairly good concentration of the dye, and it is also known that a diseased gall bladder will empty its contents fairly readily in many cases. In other words, the degree of concentration of the dye is not in direct proportion to the amount of pathology existing in the gall bladder. We know that a gall bladder which contains stones is diseased, else stones would not be present; yet such gall bladders will often empty well in response to a fatty meal. Illingworth[10] in a recent article discussing cholesterosis of the gall bladder, states: "Cholecystography indicates that in uncomplicated cases the concentration of bile and the emptying in response to fats are not affected."

In many cases the major pathology is found in the outer coats of the gall bladder and not in the mucosa, and this may explain to some extent the discrepancy in concentration of the dye by a diseased viscus.

## TECHNIC OF ORAL CHOLECYSTOGRAPHY

The technic used in our laboratory is as follows:

1. The patient is given a cathartic, preferably castor oil, on the night before the dye is taken, and an enema the following morning.

2. The afternoon after the cathartic, preliminary flat films are taken.

3. Supper that same evening at 7 P. M. consists of dry toast, baked Irish potato or cream of wheat, or oatmeal, and either tea, coffee or water. No milk is allowed.

4. One hour later (8 P. M.), Keraphen, a powdered preparation of tetraiodophenolphthalein, is given in a half glass of cold water, followed by a half glass of cold water. After that, no food or drink is allowed until after the first film of the series is made at 9 A. M. the following day. In our later cases, we have allowed fruit juices, weak tea, and coffee without cream after taking the dye, as they seem to have no effect on emptying of the gall bladder, and the fruit juices apparently allay nausea in some patients.

5. Films are obtained at thirteen and fifteen hours after taking the dye. Then

the patient is given a meal of two soft boiled eggs with butter, buttered toast, one glass of sweet milk and one glass of

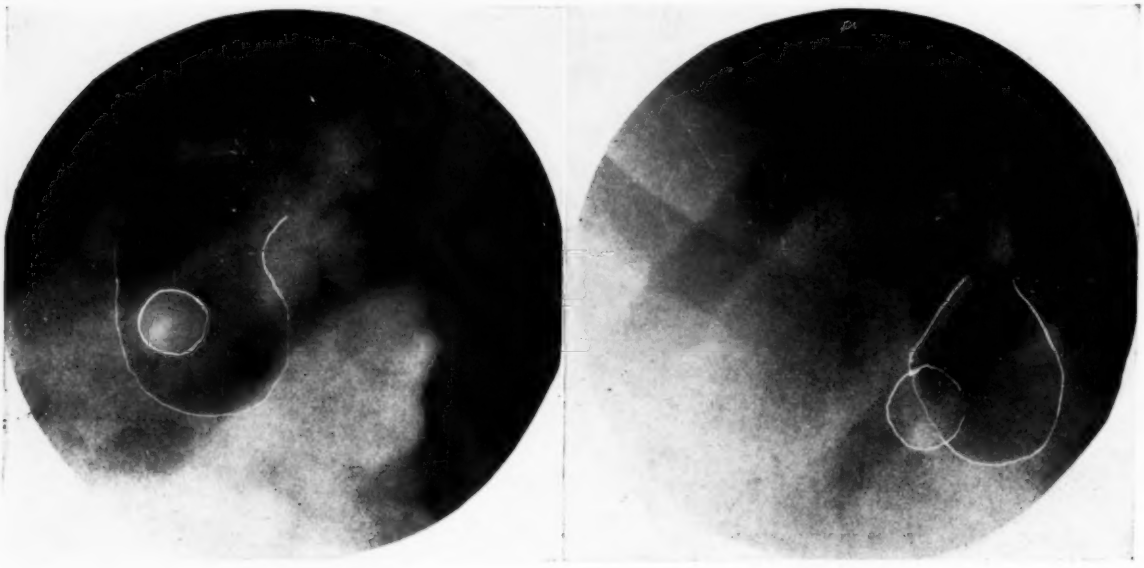

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FIG. 8. Hypersthenic habitus. Single negative density filling defect simulating stone (retouched). Compare with Fig. 7. (a) Showing single, rounded negative density shadow. 14 hrs. (b) Oblique view, showing rounded shadow partly projected from gall bladder shadow. Defect due to gas.

pure cream. Two hours later a film is made, and if the gall bladder is not at least one-half empty a second film is made at four hours after the fatty meal.

The following additional points have been helpful in employing this technic:

1. In nervous patients who are subject to nausea at the least provocation, barbital grain v or luminal grain jss is given two hours before taking the dye.

2. Where a tendency to diarrhea is known to exist, paregoric dr. 1 to 2 is given one hour before the evening meal, on the same day the dye is taken. This slows intestinal peristalsis and apparently allows a better absorption of the dye. Fitzgibbon[8] has recently advocated this practice. We have employed paregoric with good results in patients who have been subjected to operations such as gastro-enterostomy or pyloroplasty, in whom small intestinal peristalsis is usually increased.

3. When such a meal is not readily available, an egg malted milk made with pure cream produces quite a satisfactory emptying of the gall bladder.

## ROENTGENOGRAPHIC TECHNIC

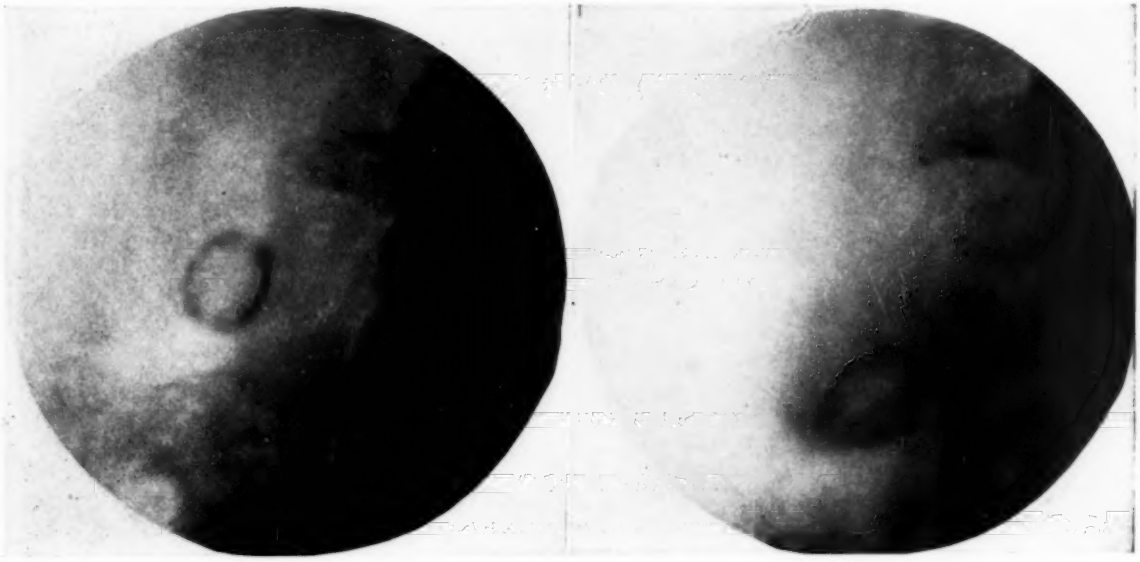
The preliminary flat films are usually made on a 10 × 12 film using fast exposure, as for a stomach, on one film; and on another we employ Bucky technic, with a medium sized cone centered over the gall bladder region.

The cholecystograms are made with Potter-Bucky technic, a comparatively low voltage, 25 ma. double screens, cone. Two exposures are usually made, to produce varying densities. If the gall bladder is unusually high, one film is made in inspiration; otherwise expiration is the method of choice. If the transverse processes of the spine overlap the gall bladder shadow, an oblique or lateral view is taken. Where spine pressure affects the dye shadow, sand bags are used to support the patient from the table, or films are made in the erect position.

The films should show: good density of the spine and ribs; the outline of the liver edge; the outline of the right kidney and a clear outline of the gall bladder. Over-exposure is the most common fault. Any respiratory movements make the films worthless, especially in detecting small stone shadows.

When stone shadows are seen, or even suspected, a film should be made after the emptying meal, since the stones may often be better detected when they are more closely packed together in the contracted viscus. The persistence of identical negative density shadows in the filled and partly emptied gall bladder definitely confirms the nature of such shadows.

Where gas shadows simulate stones, several examinations in various positions may prove the true nature of the shadows in question.



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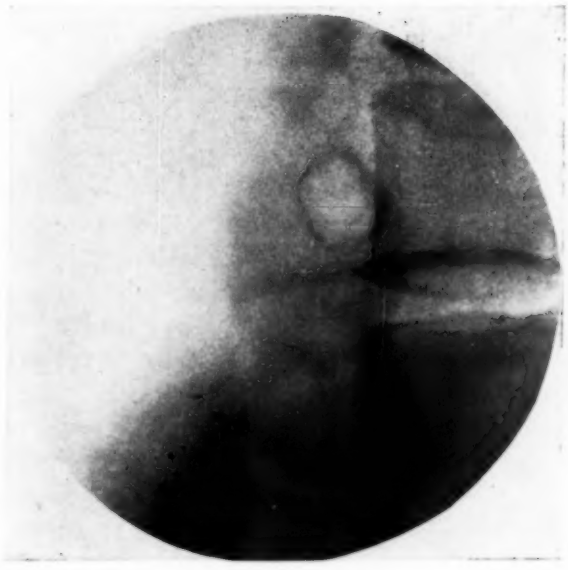

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Fig. 9. Use of cholecystography to confirm diagnosis of opaque gallstone, shadow of which noted on upper edge of uterosalpingograph. (a) Rounded opaque shadow noted on flat film. (b) Fourteen hours. Posteroanterior view. (c) Fourteen hours. Lateral view. Note ring shadow remaining within limits of dye shadow.

### Analysis of 216 Roentgenologic Examinations

A study of 216 consecutive examinations of the gall bladder made in our clinic is here presented. Of this number, 14 patients had only flat film examinations without cholecystography. The remaining 202 had either cholecystography alone or a preliminary flat film examination followed by cholecystography. The 202 cholecystograms represent 202 cases; in many of these the examination was repeated at least once, so that the actual number of roentgenologic examinations was somewhat larger.

The cholecystographic findings were classified as follows:

1. *Normal.* In this group are those patients showing a normal concentration of the dye in from twelve to sixteen hours after ingestion, and emptying of at least one-half the dye in two hours after taking the fatty meal described in the technic.

2. *Pathological.* These were divided as follows:

a. Absent shadow.
b. Faint shadow.
c. Mottled shadows suggestive of calculi.
d. Delayed emptying.

e. Definite calculi shadows.

3. *Repetition of Examination Requested but Not Obtained.* Cause of such request.

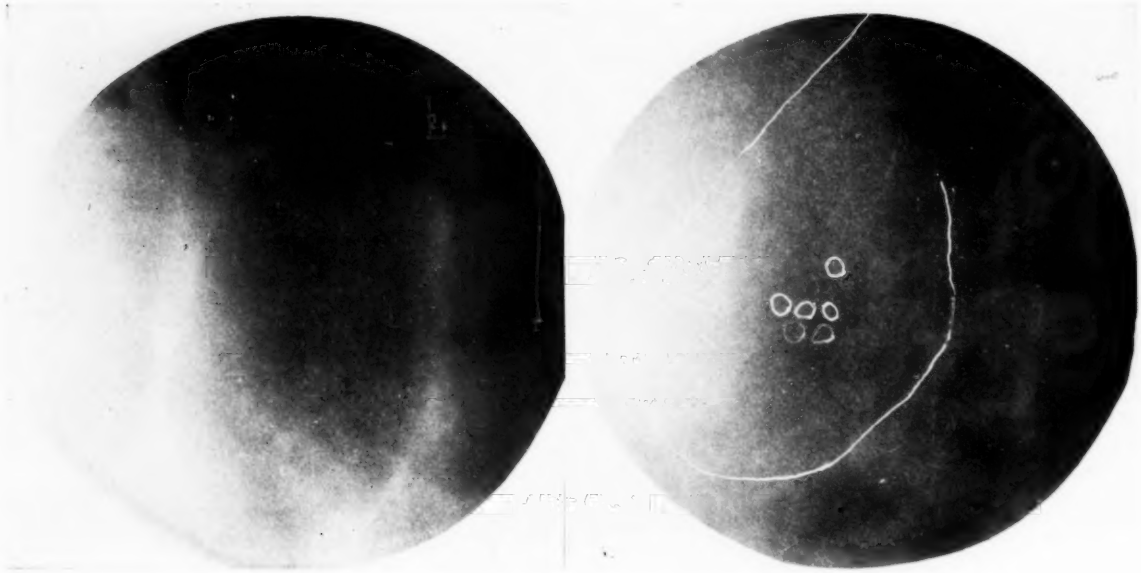

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FIG. 10. Two cases of hydropic gall bladder containing calculi, confirmed at operation. (a) Fourteen hours. Note large shadow with faint dye concentration. Negative shadows can be made out in lower portion of gall bladder. 36 stones found at operation. (b) Hydropic gall bladder. 16 hrs. 6 cholesterol stones found at operation; purulent material in gall bladder. Dye concentration faint on original film; retouched.

a. Absent shadow.

b. Faint shadow.

c. Confusing gas shadows.

The results of the examinations, grouped here, were as follows:

1. *Normal,* 78 cases or 38 per cent.

2. *Pathological,* 113 cases or 51 per cent, divided as follows:

a. Absent shadow, 23 cases or 20 per cent.

b. Faint shadow, 43 cases or 38 per cent.

c. Mottled shadows suggestive of calculi, 12 cases or 10 per cent.

d. Delayed emptying, 18 cases or 16 per cent.

e. Definite calculi shadows, 17 cases or 15 per cent.

3. *Repetition of Examination Requested but Not Obtained.* Eleven cases divided as follows:

a. Absent shadow, 7 cases.

b. Faint shadow, 3 cases.

c. Gas defects, 1 case.

All cases classified as pathological were subjected to a repetition of the study where the first examination was unsatisfactory. We regard repetition of the test as one of the most important features of a carefully made oral examination.

It is noted that cases showing no shadow and those showing definite calculi shadows constitute about one-third of the total pathological cases. The other two-thirds, in which a diagnosis of pathological gall bladder was based on the less definite findings of faint shadow, mottled shadow and delayed emptying, offer the chief diagnostic problem, and to my mind the richest field for future developments in cholecystography. Oakman[9] recently called attention to the diagnostic value of the faint shadow in oral cholecystography. It is in these cases that the personal equation of the evaluation of a normal shadow enters. They offer more diagnostic pitfalls than any other group of cases, and deserve the careful consideration of everyone interpreting cholecystograms. Technically good films are a necessity here, since under or over exposure may render it difficult to judge the actual concentration

of the dye. Moore, Graham, et al.[4] state that retention of the dye beyond a two or three hour period after a fatty meal is of no pathological significance if concentration is normal prior to the meal, and offer as explanation either reabsorption of dye from the intestinal tract or prolongation of the starvation period. In case of a faint shadow coupled with delayed emptying, the diagnosis of a pathological gall bladder may be safely made. This certainly is true of the hydropic gall bladder, and 2 such cases are included in this series and were confirmed at operation.

Of the 200 patients examined 30, or 14 per cent, have to our knowledge come to operation. These cases have been reviewed as follows, comparing the roentgenologic diagnosis and the operative diagnosis:

Of the 26 cholecystographies in which a diagnosis of "pathological gall bladder" alone was made thirteen times all 13 showed a chronic cholecystitis and 4 also showed stones, an agreement of 100 per cent in the preoperative and postoperative diagnosis.

Of 6 cases in which stones were diagnosed, 6 showed stones at operation, an agreement of 100 per cent.

Of 4 cases diagnosed as normal, 2 were normal and 2 showed calculi, an agreement of 50 per cent. A review of these films indicates that the degree of dye concentration was below normal and the diagnosis of a normal gall bladder was not warranted in the face of the faint shadow.

In 3 cases in which a repetition of the test was asked but not obtained, 2 were normal and 1 showed a chronic cholecystitis at operation.

Of 3 flat film studies which showed no pathology but in which use of the dye method was requested, 1 case was normal and 2 were pathological, of which 1 had a gumma of the liver in addition to a diseased gall bladder.

In 1 flat film study showing stones, diagnosis was confirmed at operation.

## COMMENT

The writer wishes to emphasize that cholecystography represents only one witness for the prosecution in the case against the diseased gall bladder. It is not infallible. The roentgenologic findings should be carefully correlated with the history, physical findings and laboratory reports, and in borderline cases, if the clinical indications of a diseased gall bladder are stronger than the roentgenologic evidence, then the clinical findings should form the basis of the diagnostic decision.

It is also to be remembered that a recent mild attack of cholecystitis may leave the gall bladder so little impaired that dye concentration is normal. Failure to recognize this fact may lead to error in the retrospective diagnosis of recent attacks of upper abdominal pain.

If cholecystography is employed with a full recognition of its possibilities and its limitations; with proper regard for details of technic; with judgment in interpretation; and with broad clinical approach to the case in question, then and only then, is it a reliable aid in the diagnosis of chronic gall bladder disease.

## SUMMARY

1. The diagnosis of chronic gall bladder disease is discussed with reference to the symptomatology, differential diagnosis, laboratory diagnosis, and roentgenologic diagnosis.

2. Thirty operated cases are analyzed according to symptomatology.

3. The rationale, technic, and interpretation of cholecystograms are discussed.

4. The findings in 216 consecutive examinations of the gall bladder are tabulated.

5. Comparison of the roentgenologic and operative diagnosis in 30 operated cases is presented.

6. Comment is made upon the relative position of cholecystography in the diagnostic scheme in chronic gall bladder disease.

[For Bibliography see p. 38..]

# INTRINSIC CARCINOMA OF THE LARYNX*

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WITH the exception of surface carcinoma, there is no location in the body where the results of surgery are more satisfactory than in laryngectomy for intrinsic carcinoma of the larynx. However, the majority of cases of carcinoma of the larynx are in so advanced a condition when first seen by the laryngeal surgeon, that it would seem either the diagnosis is extremely difficult and the condition poorly understood, or that there is an unwarranted prejudice against the operation.

Let us consider the differential diagnosis of carcinoma of the larynx.

There are no other carcinomatous lesions that indicate their presence so early and so definitely as carcinoma of the larynx. We know that 90 per cent of carcinoma of the larynx have as the initial symptom a persistent hoarseness, with pain, dryness and dysphagia developing as later symptoms. Yet it has been shown that there is an average lapse of eleven and a half months between the onset of hoarseness and the time a definite diagnosis is made. The blame for this cannot be wholly ascribed to the profession. The patient, not having been taught the seriousness of the symptom, usually treats his condition with home remedies and, because there is little discomfort associated with the hoarseness, delays seeing a physician.

Considering hoarseness as the early and predominant symptom, let us see what the other conditions are that produce hoarseness, and present some of their differential points.

1. *Simple Chronic Infections*, secondary to chronic tonsillitis, sinusitis, infected teeth, inordinate use of tobacco and alcohol, hysteria and excessive use of voice. This hoarseness is usually transient and readily clears up when the causative agent is corrected.

2. *Specific Chronic Infections.* Leprosy and rhinoscleroma at times occur, but by far the most common and perplexing lesions to differentiate from carcinoma of the larynx are syphilis and tuberculosis of the larynx.

(a) Syphilis, almost invariably, is a diffuse lesion of the larynx, which develops rapidly and ulcerates early, has little or no associated pain and is usually demonstrated by a positive Wassermann reaction.

If found in conjunction with cancer, a positive Wassermann reaction is one of the stumbling blocks in the retardation of the diagnosis. With antiluetic therapy the slow and temporary improvement in the laryngeal carcinoma is, for a period, misleading, because after a few months the lesion rapidly takes on a more definitely carcinomatous nature and valuable time has been lost. In true laryngeal syphilis, besides typical characteristic lesion, the growth recedes with such unmistakable rapidity under antiluetic therapy that any question of doubt as to the causative agent is removed.

(b) Tuberculosis of the larynx is nearly always secondary to tuberculosis of the lungs. It has its origin in the inter-arytenoid space and is usually symmetrically bilateral and most marked on the posterior portion of the pharynx, associated with a pale edematous area around it. Ulceration is rather early and quite painful, and with it, dysphagia.

By *x*-ray examination of the lungs and examination of sputa, and by its response to ultraviolet light therapy the tuberculous lesion is easily distinguished.

3. *Benign Neoplasms.* Papillomas, angiomas, fibromas, all generally occur early in life. Singers' node is a benign occupational hypertrophy which clears up readily with rest.

4. *Prolapse* of the ventricle of the larynx is usually transient.

* Read before Kentucky Midland Medical Society, July 10, 1930.

5. *Postoperative Laryngeal Paralysis* is more often associated with thyroid operations, and usually improves in three to six months.

6. *Sarcoma of Larynx*, occurring in youth, accounts for only 2 per cent of the laryngeal newgrowths and carries a poor prognosis.

7. *Carcinoma of Larynx* occurs most often after the thirtieth year in men, and constitutes 98 per cent of the malignant neoplasms of the larynx; 96 per cent of these are squamous cell in type and are of Group 4 malignancies.

Thus we see from these conditions that cause hoarseness, none is without a serious outlook if not properly treated in its incipiency, and we can assert that hoarseness per se warrants early attention and correction.

Any person over thirty years of age who is subject to voice changes or persistent hoarseness should be told the possible seriousness of such a symptom and be given a thorough indirect laryngeal examination by a competent man as soon as possible. If any question of a doubt in the diagnosis arises, direct laryngoscopy should be resorted to. Unless the condition clears up, repeated examinations should be made, at least once a month, until the hoarseness has disappeared, or a definite diagnosis ascertained.

A misleading impression has crept into the literature that immobility of the cord is an early diagnostic sign pathognomonic of carcinoma of the larynx.

We know that any interference with the movement of the vocal cord is dependent upon the location, extent and type of the lesion present. In the case of cancer, the immobility is caused by the neoplasm penetrating into the subadjacent muscles, and the more superficial the growth, the less probable is the infiltration into the muscles. It follows that the diagnosis should be made before the cord becomes immobile, for, as an early sign we find that the cord is immovable or impaired in its motion in about 56 per cent of the cases, but in 44 per cent of the early cases there is no disturbance in the mobility of the cord; so this, as an early diagnostic sign, is not reliable, and is of little importance in differentiation between carcinoma and syphilis or tuberculosis.

It is very important that the diagnosis be made before the cord becomes immobile. For immobility is usually dependent upon infiltration posteriorly into the base of the arytenoids, together with the extension of the growth in three possible directions.

1. Across the anterior commissure,
2. Posteriorly to the ventricular band on the epiglottis,
3. And downwards to the cricothyroid membrane.

If such an extension be present lymphatic channels are invaded and metastasis, in that event, is probable. From this we may infer that the cords that are fixed offer the poorest prognosis. This statement is borne out by reports of St. Clair Thompson in which he states that 84 per cent of the cases with movable cords operated upon have a three-year cure, while only 44 per cent of the cases with fixed cords have a three-year cure, showing how necessary it is that the diagnosis be made before fixation of the cord is present.

Fortunately, intrinsic carcinoma of the larynx, even in a rather developed stage, is still a local process, as its location in the laryngeal box cuts it, to a considerable degree, from the lymph channels of the neck, and it commonly metastasizes in two directions, either posteriorly, through the esophagus, or upwards, towards the epiglottis and lateral pharynx.

When laryngeal carcinoma is found upon examination, the following factors aid in making the prognosis more optimistic: (1) the growth does not involve the posterior portion of the larynx; (2) the extension of the growth is downward and forward rather than upwards; (3) age of incidence forty to sixty years; (4) the usual slowness and superficiality of the growth.

Let us, at this point, remark that we can see only about one-third of the growth

by laryngeal examination and an estimation of the size must be made from this visible portion.

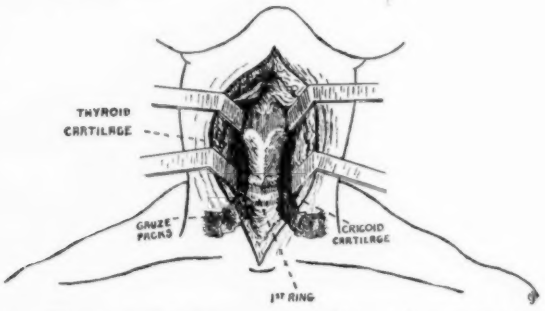


Fig. 1. First stage laryngectomy. Hyoid bone divided and retracted. Larynx and trachea skeletized. Gauze packs placed down to esophagus.

If, with all of these aids towards a conclusion, we still cannot arrive at a definite diagnosis, there is one other procedure to which we may resort, namely, biopsy. A biopsy should never be done unless the consent for a laryngectomy has been obtained, if the specimen proves malignant; and if indicated, the operation should be performed within three days of the date of biopsy. In taking a biopsy a piece of tissue should be removed by a sharp punch forceps, one bite being taken from the edge of the growth and another from the center, and great care should be exerted to avoid crushing, manipulation and bleeding. There should be a rapid examination of the tissue. However, this procedure is being used less and less and some strongly advise against it. Diagnosis is best made without biopsy because of the rapid spread of the growth afterwards.

Even when a diagnosis of carcinoma has been definitely decided upon, there is a group of pessimistic men who will not advise operation. Some object to the operation because of the loss of voice, though this is necessarily inevitable as the disease progresses, long before the fatal termination. Furthermore, those patients that have laryngectomy develop an esophageal voice from one to three months after the operation, which can be so trained that they are able to carry on such a profession as medicine or law.

Another objection frequently advanced is that there is no real recovery from the operation. The mortality is as low as 3

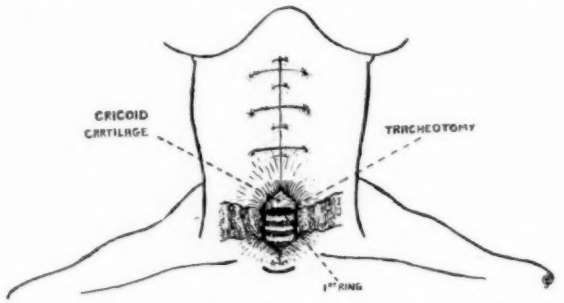


Fig. 2. Trachea opened and gauze packs replaced.

per cent. Patients become useful, active citizens, capable of continuing their life work, and of realizing, if not to its fullest, at least to a very large extent, the joy of living a rounded and enthusiastic life. They are not derelicts or operative curiosities, and are freed from the certain inhuman agony and suffering in the terminal stages of the disease, slow death from gradual suffocation. Whatever the means of relief in this condition, it is more than worth while.

I have no desire, at this time, to enter into a discussion with the specialist in this field regarding the advisability of interlaryngeal operations, thyrotomy, hemilaryngectomy, or other types of laryngeal operations advocated; but wish to discuss briefly two points: one, the use of radium, and two, laryngofissure, and then will confine the remaining remarks to important points in the care of a laryngectomy patient.

It is believed by most laryngologists that radium should be used in those cases that cannot be treated by surgery, or when, following surgery, there is a question of metastasis, for as yet surgery far surpasses any form of radium or *x*-ray treatment.

Laryngofissure, an excellent procedure in properly selected cases, is only suitable in incipient cases; and, unless the disease is diagnosed quite early, laryngofissure is not the operation of choice. In any event it should not be attempted in the following

conditions: (1) when the laryngeal growth is on the posterior third of the cord, because of proximity to the esophagus and

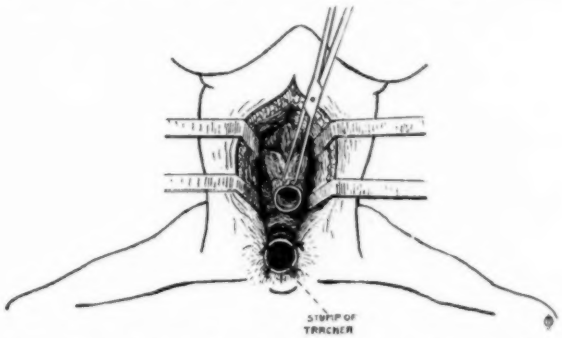


Fig. 3. Second stage laryngectomy. Trachea fixed to skin. Larynx removed from below upward.

the possibility of early metastasis and an unsatisfactory, incomplete removal; (2) with the growth in the anterior commissure crossing the midline; (3) or in rapidly growing cancers, of any size, posteriorly and especially in the young; (4) it should not be done in growths starting in the deep structures of the larynx; (5) in growths occupying over one-third of the cord; (6) never in bilateral carcinoma; (7) nor when the cricoid ring is involved; (8) nor in cases with complete fixation of the cord.

To sum up, laryngofissure should only be performed in very incipient cases in the anterior quarter of the cord, where a liberal amount of normal tissue can be excised with the growth, and even in some of the best hands, in localities best organized to treat the laryngeal carcinoma, there is a recurrence of the disease after laryngofissure in 35 per cent of the cases.

However, these incipient growths, which might be cured by laryngofissure, are very rarely seen in the average clinic. In most cases we are left to proceed with the good common sense advocated and the methods used in general surgery in the treatment of other types of cancer: namely, we "strike" wide of the disease to achieve a complete cure, and are dissatisfied with less than ¼ in. leeway of normal tissue in excision of the carcinoma. We know that it can only be killed with one shot, and the bull's eye must be hit; if the shot is not perfect the results are likewise imperfect. At present, for the great majority of the cases seen we should resort to laryngectomy.

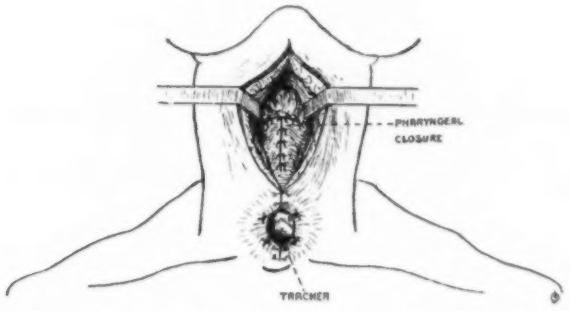


Fig. 4. Second stage laryngectomy. Pharyngeal closure completion of tracheal fixation.

The results from a laryngectomy are dependent upon the proper selection of cases, but even in some of the well-developed carcinoma we are able to obtain as high as 70 per cent five-year cures, with the incidence of recurrence less than 3 per cent. If not cured, the patient can be spared the intolerable, prolonged death from cancer of the larynx, and die in comparative comfort from metastasis. To swell your statistics cases can be refused; but to help your fellowmen, give them a warranted chance and the result will be astounding.

Operations for cases of carcinoma of the larynx should be done by an experienced general surgeon or specially trained laryngologist in the best equipped hospitals, with every facility of medicine and emergency aids at his disposal.

There is no other operation that needs such scrupulous attention to details as a case for laryngectomy. The preparation of the patient demands a rigid examination, study of chemical balance and metabolic rate, removal of foci, digitalization of the heart, a low protein diet, high fluid balance, and soda bicarbonate enemas for six to eight days before the operation. Two or three days before the operation a Refuss tube for feeding is inserted so that the patient may become accustomed to it before the operation. Rest, relaxation, and relief from worry are necessary, and the

patient should be in the best possible general health.

Special points in the operation are, local anesthesia by novocaine block and infiltration, and the avoidance of general anesthesia whenever possible. The larynx is completely exposed and laterally packed before the trachea is opened with the resulting contamination. A tracheotomy is done at a period of twenty-four to thirty-six hours after the initial procedure. The second stage of the operation is ten to fifteen days later, after all suggestion of reaction has subsided and the general condition has regained its reserve. The tracheal packing is then removed and the trachea is severed from the larynx and a tracheal skin union made by stay sutures, so as to give a permanent opening and fixation of the trachea that will not collapse. The insertion of the special tracheotomy tube prevents the blood from entering the trachea during the remainder of the operation.

The larynx is then dissected from below upwards, and by blunt and sharp dissection is dissected from the pharynx, leaving as small a stroma as possible which should immediately be closed by layer suture, while the remainder of the wound is closed with through and through suture with ample drainage of iodoform gauze and cigarette drains in the wound. The patient is put in semi-Fowler's position and the most careful nursing and postoperative regime followed out. No accumulation of serum or blood is allowed to collect in the wound or trachea, and this demands a highly trained nurse. The postoperative care should be done by the surgeon, as in most instances it calls into play all his surgical ingenuity, and unless he is ahead of the treatment of the condition it will certainly terminate fatally. After hospitalization for ten to thirty days the patient has healing of the wound, and when strength is regained can resume his usual activities. The period of voice training begins as soon as the feeding tube is removed, which is usually in about ten days, if the healing of the esophagus is primary. The amount of voice that is developed is dependent upon the intelligence and cooperation of the patient. The voice is effected by expansion and contraction of the esophagus; before speaking the patient aspirates air into the upper two-thirds of the esophagus, and with the trained contraction of the esophagus, air is forced into the throat. The voice is usually better when the stomach is full. In from one to four months the patient may train his voice so that he may carry on his usual profession. The use of artificial larynxes has been satisfactory in some cases, but not wholly so.

## SUMMARY

1. Early diagnosis of carcinoma of the larynx is dependent upon the education of the public to the seriousness of persistent hoarseness in a person over thirty years of age, and an immediate recognition of the cause of this hoarseness.

2. Until carcinoma of the larynx is diagnosed in its incipiency, laryngectomy is the operation of choice, but should only be attempted by one skilled in the operation after meticulous selection, preoperative care and with untiring postoperative care, and persistent after-treatment and reeducation.

3. Laryngectomy can cure 70 per cent of intrinsic carcinoma of larynx with only 3 per cent mortality and about 3 per cent recurrences; returning to society self-supporting people able to carry on their usual work and enjoy a comfortable, useful life.

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EXPERIMENTAL STUDIES ON THE EFFECT OF

# THE PROLONGED USE OF COLON ENEMAS UPON THE BOWEL IN ANIMALS*

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ENEMAS have been utilized for centuries for the relief of constipation as well as in the treatment of various affections of the bowel; but little attention has been directed, however, to the ultimate effect upon the bowel itself, following the prolonged use of this method of treatment. It is well known, that due to the immediate relief afforded as the result of enemas and irrigations, a habit is not infrequently formed and an abuse of this method of treatment not uncommonly occurs. In fact, in recent years, the all too frequent use of enemas as well as irrigations which are practiced not alone under the supervision of physicians, but by others as well has often led in our experience to the production of certain colonic affections as well as nervous intestinal disorders.

This may be brought about in some instances at least by lowering the resistance of the bowel by the habitual application of this method of treatment in consequence of which inflammatory changes of a more or less severe type are apt to follow.

On the other hand, colonic irrigations alone, rarely result in a distinct cure but in accomplishing their immediate effect often cause an interference with the normal function of the bowel.

Since but few scientific investigations on the effect of rectal enemata upon the bowel have been recorded, it seemed important to us that a further study of this problem should be undertaken. On this account we attempted to study in animals, the effects of frequent prolonged rectal injections of solutions commonly administered in the routine treatment of bowel affections as well as the effect of various chemical irritants on the colon.

In these experiments 34 male dogs of medium size were utilized. During this period the animals were allowed the usual

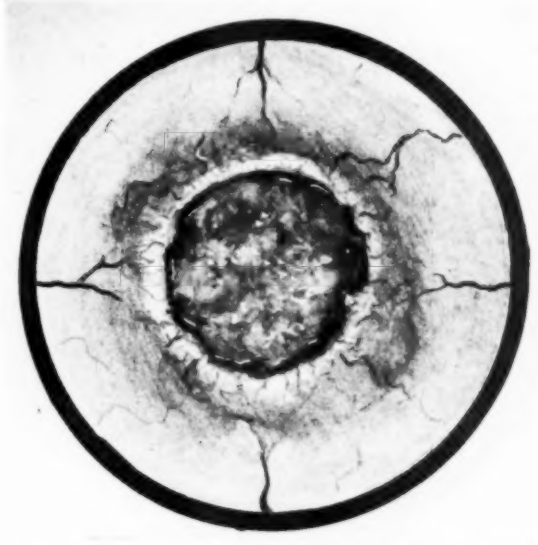

FIG. 1. Ulcerative colitis. Ulcer, occurring ninety-five days following use of sodium carbonate solution.

diet ordinarily consumed by laboratory dogs. It is important to call attention to the fact that the colon of the dog differs from the human in that it is extremely short, varying in length from 30 to 45 cm. and that the ileocecal valve is patent to such a degree that fluids when injected per rectum, pass freely into the small bowel. In a single instance, a barium enema was vomited almost immediately following its administration. On this account solutions introduced into the rectum produce a variety of changes affecting not only the large but also the small bowel as well.

In this study, the following solutions were administered rectally:

1. Plain water
2. Soap water

* Read at the Thirty-third Annual Meeting of the American Gastro-Enterological Association, Atlantic City, May 5, 1930.

3. Cotton seed oil
4. Sodium carbonate solution
5. Neutral acriflavine solution

protoscopic and stool examinations were made. Pathological studies of the entire bowel were also made, following death.

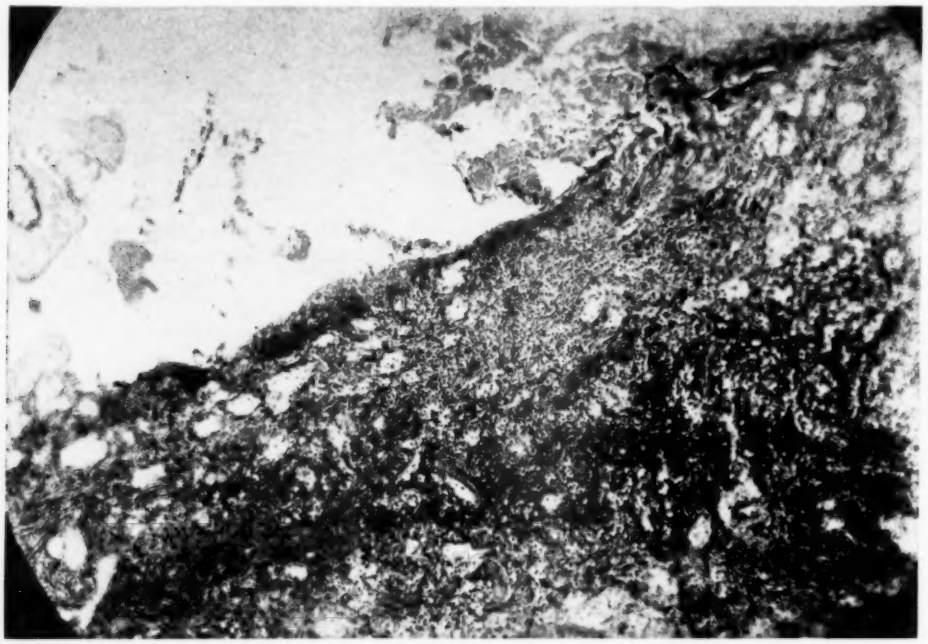

FIG. 2. Same dog, microscopic specimen; ulceration undergoing extensive necrosis. Low power.

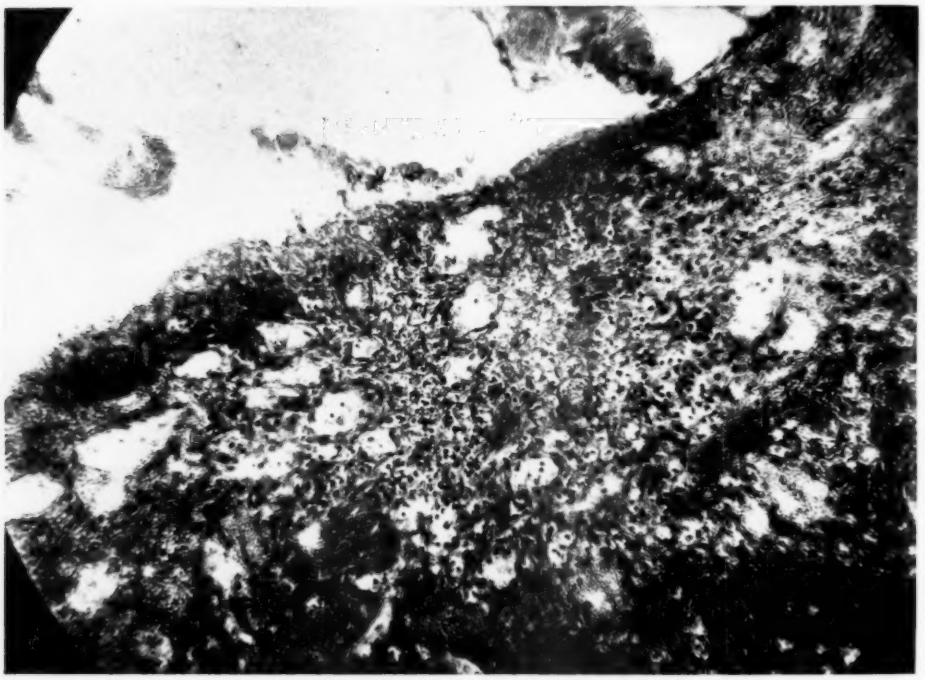

FIG. 3. Same dog. High power.

6. Camphor water
7. Ammonium chloride solution
8. Hydrochloric acid.

During the period of treatment, frequent

1. *Plain Water Enemas.* Three dogs were utilized in this experiment; 250 c.c. of tap water were injected once daily for 155 days. Following three months' treat-

ment proctoscopic examinations of the bowel revealed no abnormalities. After five months, the proctoscopic examinations showed a slight redness of the mucous membrane. These dogs were killed on the one hundred and fifty-fifth day and the following pathological findings were noted. In one dog the gross as well as the microscopic, appearance of the various parts of the bowel revealed no abnormalities. In the second and third dogs, a congestion of the colon with hemorrhagic areas, 7.5 cm. from the rectum and 45 cm. above the cecum were observed.

It is interesting to note that Hirschman[1] calls attention to the fact that even plain water enemas may produce in man a very slight deviation from the pearly pink of the normal mucous membrane. He also suggests that the flushing of the colon with gallons of water, plain or medicated, as is not infrequently practiced not only distends the bowel but also causes hyperemia.

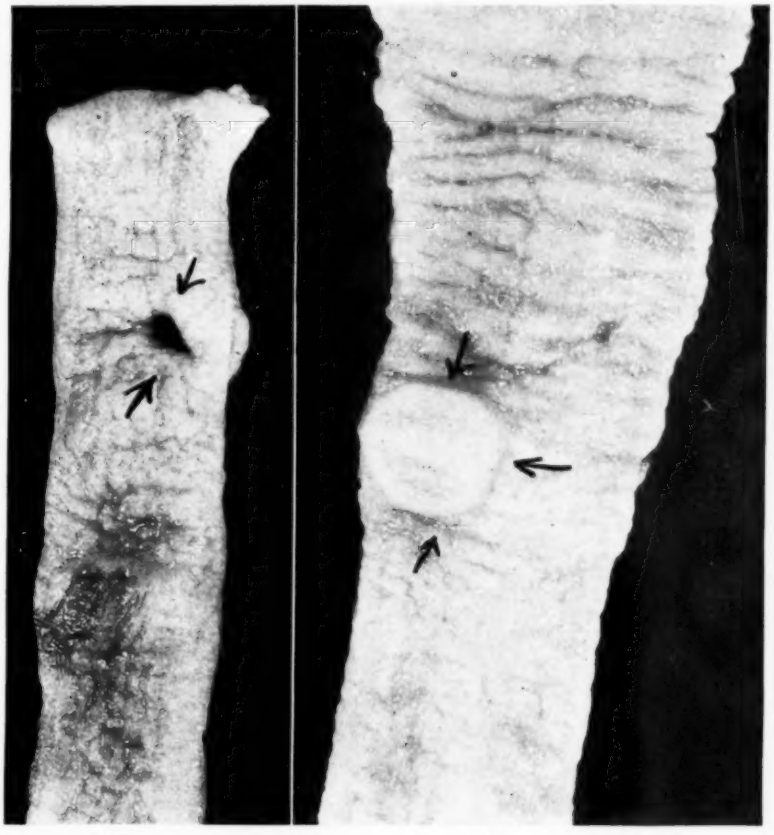

Fig. 4. Fig. 5.

Fig. 4. Perforated ulcer of ileum following application of 0.5 per cent solution of dilute hydrochloric acid for thirty days. Blood and mucous observed in stools.

Fig. 5. Same dog, showing hyperplasia of Peyer's patches.

These observations are in accord with our findings following the prolonged use of enemas in animals.

2. *Soap Water Enemas.* Three dogs were given soap water enemas for one hundred and twenty-nine days. In two and one-half months following treatment, the proctoscopic examination revealed a normal colon in 1 instance and a slightly inflamed mucous membrane in 2. One and one-half months later, the proctoscopic study showed the mucous membrane slightly reddened and glary, as the result of a plastic proctitis. On the one hundred and twenty-ninth day, these dogs were killed for pathological study. The bowel was found normal in 2 dogs and the colon

[1] Hirschman. *J. A. M. A.*, 89: 1039, 1927.

was congested and thickened in 1; the small bowel also revealed injected vessels.

Runge and Hartman[1] who studied the effect of rectal injections of soapsuds, observed that ulcerations, hemorrhages and actual necroses were produced in rabbits within three days following the use of .5 per cent solution. According to Mond,[2] these lesions are dependent upon the destructive effect of the lipoid soluble molecule in the soap. Hirschman[3] likewise points out the irritating effect of soapsuds enemas on the mucous membrane of the bowel with the production of a proctitis in the human subject.

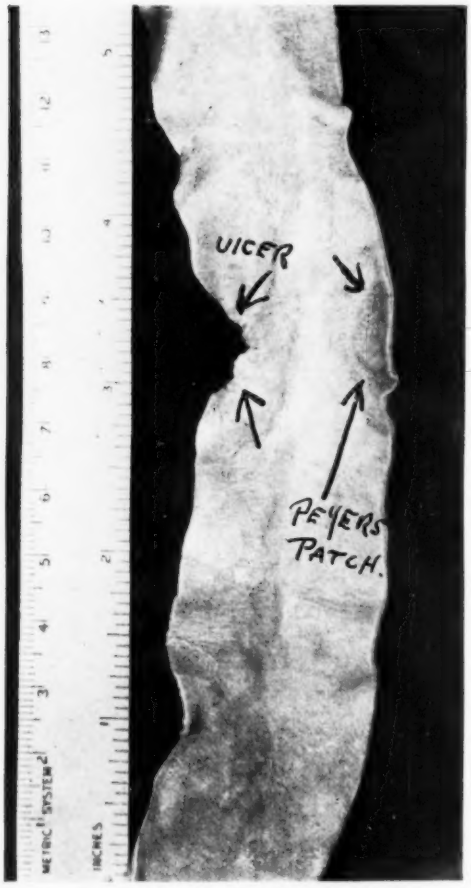


Fig. 6. Constricted area in ileum, with perforated ulcer. This occurred under hydrochloric acid treatment.

3. *Cotton Seed Oil Enemata.* Three dogs were utilized in this experiment. Three ounces of oil were injected rectally daily for one hundred and twenty-seven days. During all of this period, the stools remained normal. The dogs were then killed and the appearance of the bowels studied. In 1 instance, the entire bowel retained a perfectly normal appearance. In the other 2 dogs, a slight injection of the vessel was observed involving about 3 in. of the bowel above the anal orifice. The colon otherwise appeared normal. It is quite possible that these minor changes were produced by the irritation of the constant introduction of the hard rubber tube.

Fig. 7. *X*-ray of gastrointestinal tract following use of acid, showing marked hypermotility of entire intestinal tract following barium meal by mouth; note small amount of barium in stomach and stringing of small and large bowel.

4. *Sodium Carbonate Solution.* A solu-

[1] Runge and Hartman. *Klin. Wchnschr.*, 7: 2389, 1928.

[2] Mond. *Pflüger's Arch.*, 217: 313, 1927.

[3] Hirschman, *J. A. M. A.*, 89: 1039, 1927.

tion of sodium carbonate gradually increased in concentration from 5 to 20 per cent was injected rectally in 3 dogs. Two

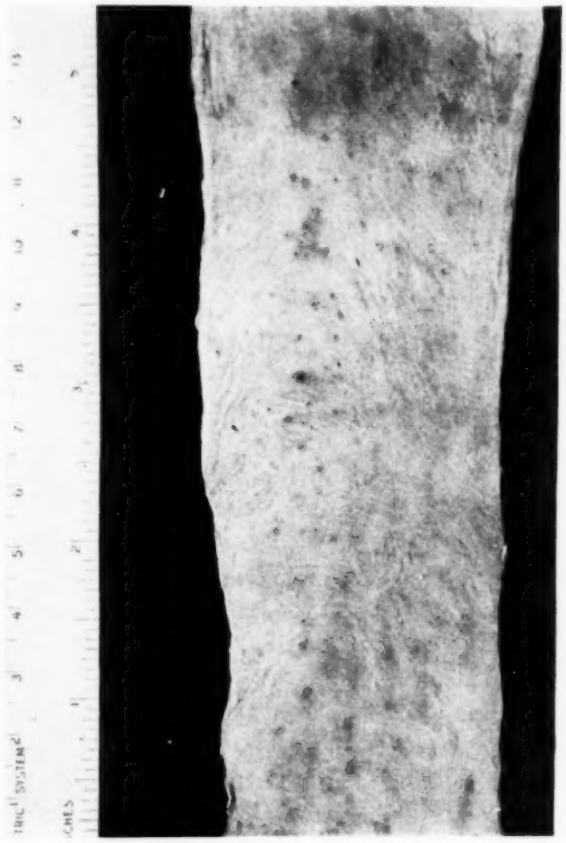

Fig. 8. Small punctate areas observed in large bowel, due to hyperplasia of lymph follicles, following use of ammonium chloride solution.

of these dogs died as the result of the toxic effect of this chemical and one was killed. One died after sixty-three days' treatment and presented a congestion of the large bowel with marked hyperplasia of the lymphatics. The small bowel showed a hyperplasia of Peyer's patches. The second dog passed bloody stools on the one hundred and tenth day and died five days later. At autopsy, the large bowel presented hemorrhagic areas, which extended into the cecum and lower ileum with areas of necrosis and sloughing. The lymphoid elements revealed a marked hyperplasia. A microscopic examination showed the following pathological changes. The epithelium presented various grades of degeneration varying from extreme swelling to complete necrosis. In areas the mucous membrane showed sloughing with the formation of ulcers, the bases of which

Fig. 9. Early congestion and injection of blood vessels, and also hyperplasia of lymph follicles under ammonium chloride treatment.

were formed by the submucosa. None extended as deep as the muscularis. The submucous tissue at the base of the ulcers contained many dilated blood vessels and many filled with red blood corpuscles. The lymphatics also were dilated showing diffuse lymphatic infiltration. Marked congestion and edema were observed throughout the section. The muscle was not involved. The pathological diagnosis indicated an ulcerative colitis.

The third dog was killed on the one hundred and seventy-fifth day. When proctoscoped on the one hundred and tenth day, the mucous membrane was found inflamed presenting hemorrhagic and denuded areas in the mucosa revealing the typical picture of an ulcerative colitis. The stools on a number of occasions showed blood and mucus.

5. *Neutral Acriflavine Solution* (1 to

3000). In two dogs, 3 oz. of a 1 to 3000 solution of neutral acriflavine were injected once daily for one hundred and

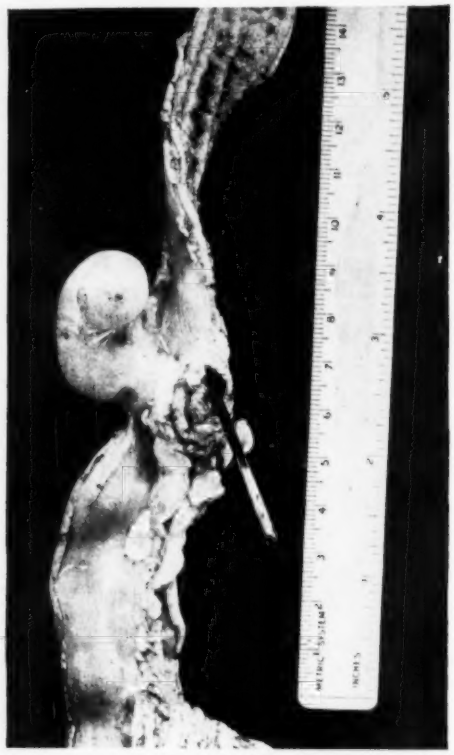

Fig. 10. Perforated ulcer in iliocecal region, following use of 1 per cent solution of ammonium chloride for one hundred and sixty-nine days.

fifteen days. The dogs were killed at this time. The appearance of the colon of one dog was normal while in the second dog, there were evidences of a slight hyperemia.

6. *Camphor Water.* Three ounces of a solution of camphor water (United States Pharmacopeia) were injected rectally into two dogs. One dog died after twenty-nine days, the autopsy revealing a marked thinning of the entire bowel. The large bowel presented black stripes running parallel with the bowel apparently produced as the result of pigment formation. Microscopically no abnormalities were revealed, the pigment disappearing as the result of the treatment in mounting the sections. The second dog was killed on the one hundred and eighth day and no abnormalities were observed.

7. *Ammonium Chloride.* Three dogs were injected rectally with ammonium chloride (10 per cent) solution once daily and died at periods of seven, eight and thirteen days respectively. At autopsy, the specimens showed moderate hyperplasia of the lymphoid tissue of the submucosa. An area was noted in which the mucous membrane was necrotic. Necrosis did not, however, involve the submucous tissue; on the other hand, in other areas, the necrosis destroyed the tips of the villi; while the deeper portion of the mucosa remained intact. Microscopically, the large bowel showed marked hyperplasia of the solitary follicles, the small bowel revealing hyperplasia of Peyer's patches. Inasmuch as rapid death was produced due to the toxic affect of a 10 per cent solution, weaker solutions of the same chemical were utilized, and it was observed that a similar effect occurred at periods varying almost proportionately with the strength of the solution.

Three dogs were injected with 3 oz. of a 1 per cent solution daily. After twenty-four days, one dog died and autopsy revealed changes similar to those produced with the 10 per cent solution. The other two dogs were killed after one hundred and sixty-nine days. Both showed blood and bloody mucus in the stools at various intervals. In one, a large perforated ulcer was noted in the ileum, just above the ileocecal junction and areas of inflammation were also observed.

8. *Muriatic Acid.* Eleven dogs were utilized in this experiment. In two, 250 c.c. of a 10 per cent dilute hydrochloric acid solution were injected rectally twice daily. Both dogs died on the third day following the administration of four enemas. The autopsy revealed extensive sloughing of the mucous membrane especially in the region of the cecum and terminal ileum. In these areas, the tissues presented a necrotic appearance with two large perforations in the ileocecal area in one instance and a single large perforation in the terminal ileum in the other.

Due to the rapid destruction of tissue and early death of the animals from the application of the solution given twice

daily, we decided to administer the same solution to three other dogs once daily. These dogs also died promptly following

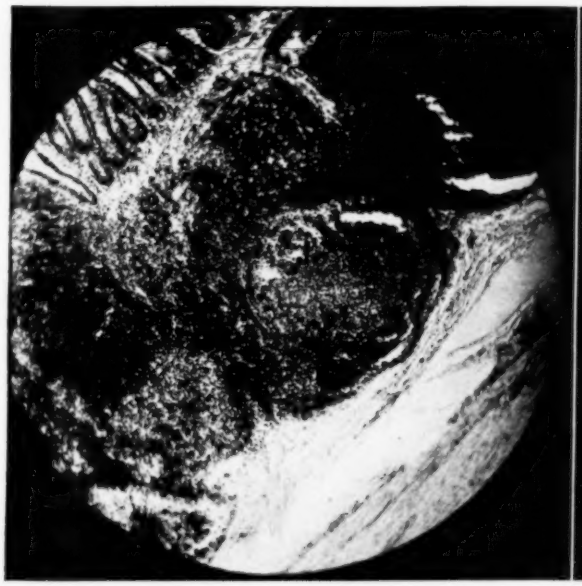

Fig. 11. Lymphatic hyperplasia. Low power.

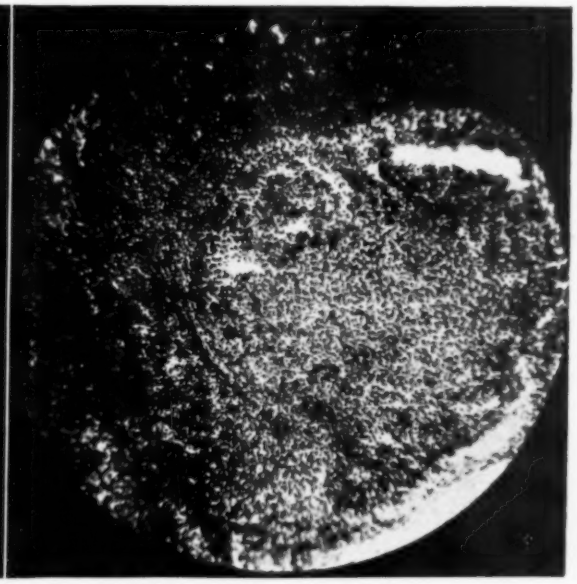

Fig. 12. High power. This finding was constantly observed in animals treated with ammonium chloride and sodium carbonate.

the use of two enemas. In two dogs large perforations were noted in the ileocecal region. In the third, extensive hemorrhages with necroses of tissue were observed in the ileocecal region. Inasmuch as the 10 per cent solution was too destructive, a 2.5 per cent solution was utilized in two dogs. All of the dogs died promptly following the use of a few enemas (three, four, and eight days respectively) presenting similar findings. A 0.5 per cent solution was now utilized in three dogs. The dogs lived thirty, fifty-three and sixty-one days respectively. The stool examination constantly showed blood and bloody mucus and the feces were diarrheic. These dogs also revealed perforations and necrosis at autopsy.

## CONCLUSIONS

As the result of these experiments, the following conclusions seem justified.

1. The prolonged use of enemas seems to result in more or less bowel disturbance.

2. The use of even simple water enemas, when applied over long periods may produce mild inflammatory changes.

3. Soapsuds enemas are apt to produce more marked inflammatory changes and even hemorrhages and ulcerations have been recorded.

4. Oil enemas appear to produce less irritation to the mucous membrane of the bowel.

Fig. 13. Peculiar pigmentation of large bowel which occurred in one instance following use of camphor water.

5. Acriflavine in 1 to 3000 solution and camphor water (United States Phar-

mocopeia) cause but slight disturbance of the bowel.

6. Irrigations with irritating chemicals such as sodium carbonate, ammonium chloride and hydrochloric acid, even in weak solutions cause inflammatory changes ranging from mild processes to extensive ulcerations and necroses.

7. Finally it appears obvious from these experiments, that the prolonged use of rectal injections and irrigations may result in the production of a variety of colonic affections of a more or less severe grade.

## DISCUSSION

Dr. Soper: In regard to the vaccine treatment in these cases I wish to say that we have corroborated Bargen's results and would not do without the vaccine in the treatment of these cases. We have had fewer relapses since we have instituted the vaccine method. As Dr. Gaither emphasized many of these cases will be clinically cured but sigmoidoscopy will reveal lesions in the rectum and lower colon. Local treatment is always indicated and we have found that a 25 per cent solution of silver nitrate carefully applied to the swab which must not touch the anal canal, is very effective. Bismuth subgallate in heaping teaspoonful doses two or three times daily is also very useful in the treatment of ulcerative colitis.

Dr. Friedenwald's paper is very timely and I hope it will check the fad of colonic irrigation that is going about the country. We observed the irritation and inflammatory processes in enema users many years ago. In some severe cases of atony of the lower colon enemas are necessary. We have found the oil emulsion enema to be less irritating than any other form. The formula is two quarts of warm soapsuds, 4 dr. of sodium bicarbonate and 4 oz. of mineral oil, well shaken up to form an emulsion.

Dr. Jones: I desire to call attention to one point in Dr. Friedenwald's paper which I think should be emphasized, and that is: where patients are advised to use enemas, the capacity of the colon should be known. In using our barium enemas we measure the exact amount of barium mixture it takes to fill the colon, because there are so many things that may occur in giving enemas that "crash the gates" of the ileocecal valve, washing colon contents up into the small bowel.

I want to mention, in connection with Dr. Portis' paper that the preparations of acidophilus milk are related to some extent at least, to the old Kephir milk, that we studied in the later '90's, and the early 1900's. We found that the gastric secretion is somewhat increased by taking them by mouth, and this may also happen with the acidophilus milk.

We must remember, also, that the age of the milk has something to do with it's action, the twenty-four-hour preparations are at times const pating, while the forty-eight and seventy-two-hour preparations will favorably influence constipation. Several years ago I published a paper along this line making comparisons between fermented milk of one, two and three days' fermentation. It seems to me that the study of its effect upon the gastrointestinal tract as a whole, is worth while, as well as a study of its effects upon the colon.

Dr. Lichty: I would like to ask Dr. Feldman whether there was any effect upon the tonus of the colon, or any change in the size of the colon, after a long series of colon washings? I would also like to ask Dr. Portis what he means by the term "implantation"? Does he use any particular technique, or special method, either per rectum or per ovis?

# THE GASTROINTESTINAL TRACT IN ANEMIA PERNICIOUS*

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THE relation of the gastrointestinal tract to pernicious anemia has been the subject of many clinical studies, considerable experimentation and much speculation. Our reasons for presenting further data bearing on this subject at this time are as follows:

1. A series of 150 patients have been studied in whom the diagnosis has been established by every known clinical procedure of value, including the therapeutic response to liver extract or desiccated stomach. All of these patients have been under observation in the hospital for a period of from a week to several months. Following discharge from the hospital, practically all patients have been observed at intervals for a length of time varying from a few months to several years.

2. In all patients a fractional test meal has been done and in about one-third of them the gastric contents were removed subsequent to the intramuscular injection of histamine.

3. The gastrointestinal symptoms were studied before and after a therapeutically induced remission.

As an introduction to the data which are to be presented, the following case history is cited as it illustrates many of the important points concerning the relationship between the gastrointestinal tract and pernicious anemia.

The patient was a physician, male, aged fifty-two, who had experienced the typical symptoms of pernicious anemia for two years before admission. The following were the interesting points relating to the gastrointestinal tract in his history: 1. His father, who died at the age of eighty, had suffered from recurring glossitis for many years, although there is no indication that he had an anemia or subacute combined degeneration of the spinal cord. A gastric analysis was not obtained. 2. Twenty-six or twenty-seven years ago the patient developed a diarrhea in the form of 1 or 2 watery stools daily with no other associated symptoms. This persisted for a period of twenty years. 3. As a result of this diarrhea the patient consulted a physician (twenty-six or twenty-seven years ago) and a gastric analysis was performed which showed a complete lack of free hydrochloric acid. This was repeated four years later and the same finding was noted. 4. Eight years ago the patient developed severe recurring attacks of glossitis which have continued up to the present date. 5. The diarrhea continued daily until about six years ago when the patient developed three rather rapidly recurring attacks of severe acute cholecystitis which led to a cholecystectomy. Following this operation all symptoms referable to the gall bladder immediately disappeared as did the diarrhea. Four years after the operation the characteristic symptoms and signs of pernicious anemia developed.

As an isolated case record this proves nothing; but when considered with collateral data pertaining to the gastrointestinal tract in pernicious anemia, it gives an accurate picture of what must be a fundamental relationship.

The data which are to be reported in this article have been assembled from a group of 150 consecutive patients with pernicious anemia who were studied in the Thomas Henry Simpson Memorial Institute for Medical Research during the past two and one-half years. Eighty-seven were males and 63 were females. The age limits varied from twenty-two to eighty years, but 86 per cent of the patients were between forty and seventy years of age and almost one-half were between fifty and sixty years of age. The following data relating to the gastrointestinal tract

* From the Thomas Henry Simpson Memorial Institute for Medical Research, University of Michigan, Ann Arbor, Michigan. Read at the Thirty-third Annual Meeting of the American Gastro-Enterological Association, Atlantic City, N. J., May 5 and 6, 1930.

were investigated in each patient: food habits, appetite, nausea, vomiting, distention, glossitis, condition of the bowels and abdominal pain. In addition, careful notes were made concerning the condition of the tongue and in each patient a fractional gastric analysis was made.

A consideration of the dietary habits of patients with pernicious anemia is of interest as Koessler and his associates[1] have suggested that the disease may result from an inadequate consumption of vitamins or a deficiency of their utilization. It is of some importance, furthermore, to determine if patients who develop pernicious anemia have consumed only small amounts of liver or excluded it entirely from their diet. All patients of this group have been asked in a general way concerning their usual diet and in 19 a more intensive investigation was carried out. A similar dietary history was obtained from 25 patients on the medical and surgical wards of the University Hospital for comparison as a control group. The latter were patients of approximately the same age, without an anemia, and in each instance there was no gastrointestinal disorder which might have influenced the choice of food. Special attention was given to the use of the following articles of diet: milk, fresh and cooked vegetables, fresh and cooked fruit, dark breads, liver and other glandular meats.* The results may be presented briefly as it is doubtful if they have a bearing on the etiology of the disease. There was a slightly greater use of milk by the control group, whereas the patients with pernicious anemia actually consumed more liver than the former; otherwise there was no significant variation between the two groups. In some instances patients with pernicious anemia had eaten a very poorly balanced diet over a period of years and it is entirely possible that this may have been a contributing although not an essential etiological factor of the anemia. These results are in accord with the study of Cornell[2] who concluded that persons who later developed pernicious anemia did not have any specific differences in their food habits from their associates who remained free from the disease.

In 60 per cent of the patients the appetite was poor, sometimes amounting to an actual aversion toward food, while in 10 per cent it was classified as fair and in 30 per cent it was normal. It is known, however, that at the beginning of a remission, spontaneous or induced, the appetite may even become ravenous; but as these patients came to the hospital during a relapse, this was not observed in our group of patients prior to treatment. It is of interest to attempt a correlation between the appetite and the level of the red blood cells. In order to do this, the red blood cell counts in 42 patients with pernicious anemia who had poor appetites were compared with the red blood cell counts of 42 patients with pernicious anemia who had good appetites. It is apparent that there is a general tendency to the development of anorexia as the red blood cell count falls, but there were notable exceptions to this. A number of patients with severe anemia had normal appetites while others with almost normal red blood cell counts had anorexia.

About 50 per cent of the patients had nausea and a similar percentage likewise had vomiting. In most instances these symptoms were of a mild nature and occurred at rather infrequent intervals. The two exceptions to this statement are that these symptoms may become prominent when they appear as early manifestations of the disease, or when they appear at the time when the anemia is severe.

Abdominal pain was present in about 25 per cent of patients, and it is usually vague, mild and not a prominent symptom. The patients usually characterize it as dull and either localized to the epigastrium or distributed diffusely over the abdomen. Some described this as a "heaviness"

* These data were collected by Mrs. Dorothy S. Waller, Dietitian of the University Hospital, who will make a more extensive report at a later date.

in the upper part of the abdomen. This discomfort in our experience is most frequently associated with distention of the intestines with gas. That it is not referable to the gall bladder may be deduced from the fact that it usually disappears within a few days after effective therapy is instituted. Severe abdominal pain is rare in pernicious anemia and when it does occur should always excite the suspicion of gall bladder disease.

Our observations concerning the functional state of the bowels in patients with pernicious anemia are in accord with a number of previous reports[3,4] which emphasize the frequency of diarrhea. In our patients, however, constipation was the more frequent symptom as it occurred in about one-half of the patients whereas in 23 per cent of the patients the bowel movements were normal. The constipation cannot always be attributed to the pernicious anemia as in some instances it had been present for years preceding the disease. In a fair number of patients with advanced spinal cord changes it appeared as though a neurogenic factor might be of importance in the production of this condition. Recurring attacks of diarrhea occurred in 14 per cent of the patients and in an additional 15 per cent there were alternating attacks of diarrhea and constipation. Combining these figures it may be said that diarrhea occurred in 29 per cent of this group of patients.

A definite and convincing history of attacks of glossitis was obtained in 65 per cent of the patients, which raises this symptom to one of considerable importance. As has been previously emphasized[5] glossitis may occur some years prior to the symptoms due to the anemia or those associated with changes in the spinal cord. In our series this symptom occurred in a small number as the sole manifestation of the disease at a time varying from one to ten years before other characteristic symptoms occurred. In an additional group of patients it was among the earliest manifestations of the disease.

Careful inspection of the tongue in each patient of this group disclosed that 42 per cent had a definite and easily recognizable atrophy of the papillae, about which there was no doubt. An additional number showed questionable slight atrophic changes but these were not considered abnormal. In others there was a redness of varying degree noted and other changes of a minor nature, but these were not included in our statistics. It was of interest to note that a patient's tongue may appear perfectly normal despite a history of severe recurrent glossitis and on the other hand there may be obvious atrophic changes without a previous history of symptoms referable to the tongue. It is likewise true that a patient with true pernicious anemia in an advanced stage of the disease may have a perfectly normal appearing tongue and have experienced no symptoms of glossitis. Regardless of the emphasis which has been placed upon the association of glossitis with pernicious anemia, this is occasionally overlooked for in some instances the anemia has not been recognized and the glossitis has been treated locally or by some other measure, such as the removal of all the teeth. The effect of the modern treatment of pernicious anemia on the glossitis is of considerable interest for in a great majority of patients it causes this symptom to disappear very promptly. In a few, however, the glossitis may persist and constitute the patient's sole complaint and in others it may disappear following the initial treatment and recur at a later date when the red blood cell count is within normal limits.

### ACHLORHYDRIA

For a great many years the work of a fairly large group of investigators has indicated that an achlorhydria exists in practically every patient with pernicious anemia. Our results amply confirm this statement for in 150 consecutive cases with the characteristic syndrome of pernicious anemia, there was an achlorhydria in every

single case. In 104 of the patients, gastric analysis was performed as follows: The gastric contents were removed after a fast of twelve to fourteen hours, after which the patient was given one shredded wheat biscuit and approximately 400 c.c. of water. Three specimens were then removed at one-half hour intervals. In the remaining 46 patients the procedure was varied somewhat as follows: After the usual preliminary fast of twelve to fourteen hours 1 mg. of histamine was injected intramuscularly. Immediately after the injections, the fasting contents of the stomach were removed. The patient was then given 300 c.c. of water and 4 or 5 specimens removed at intervals of fifteen minutes. The results in both groups were the same, as in each patient there was a complete absence of free hydrochloric acid and a uniformly low total acidity, the latter figure usually being below 10 per cent acidity, although in a few instances it was somewhat higher than this. Our experience has been in accord with a number of observers who have noted that examination of the gastric contents of patients with pernicious anemia, at a variable time prior to the appearance of the symptoms due to the anemia or spinal cord changes, has always shown an achlorhydria. In one patient of our group the achlorhydria was noted twenty-six years and in another ten years before the other manifestations of the disease. Of equal interest is the fact that with proper treatment the other symptoms disappear but the achlorhydria persists. This statement supports the work of Johansen[6] who examined 19 patients to determine this point. There are, however, 2 cases in the literature[7,8] in which free hydrochloric acid is said to have appeared in the gastric contents after recovery following the use of liver.

Concerning the achlorhydria in pernicious anemia it seems fair to state definitely that:

1. A patient has never been observed who had free hydrochloric acid in the gastric contents and later developed pernicious anemia.

2. A patient with pernicious anemia practically always has an achlorhydria. This statement is supported by our 150 cases and the reports of numerous other observers. It is possible that the few instances in which an achlorhydria has been observed, may be accounted for by a technical error, or an erroneous diagnosis.

3. Free hydrochloric acid rarely, if ever, occurs in the gastric contents in patients with pernicious anemia after the successful treatment of the disease and a disappearance of all symptoms.

## THE CAUSE OF THE GASTROINTESTINAL SYMPTOMS

In studying the cause of the gastrointestinal symptoms in pernicious anemia the following must be considered:

1. The anemia;
2. The achlorhydria;
3. A neurogenic factor associated with spinal cord changes;
4. Infection of the gall bladder;
5. An intrinsic, as yet unknown, factor involving the gastrointestinal tract which may be the fundamental etiological basis of the disease.

The anemia may have some relationship to the gastrointestinal symptoms as there is a tendency for the latter to become more pronounced as the red blood cells and hemoglobin fall to a low level. That it is not the sole factor which is involved may be deduced from the fact that some patients with a low red blood cell count have no gastrointestinal symptoms, while in others with almost no anemia, the nausea, vomiting, diarrhea and anorexia may be pronounced. The strongest evidence in favor of a lack of correlation between the anemia and gastrointestinal tract is the fact that within a few days after effective treatment has been instituted, almost all of the gastrointestinal manifestations usually disappear although at this time there is ordinarily no significant change in the total red blood cell count.

Likewise there is no convincing evidence that the achlorhydria is the cause of the gastrointestinal symptoms. This is apparent from the fact that many otherwise normal individuals with achlorhydria are symptomless and further because many patients with pernicious anemia may be symptom-free during a spontaneous or therapeutically induced remission, although the achlorhydria persists.

Some years ago Jones and Joyce[9] suggested that chronic gall-bladder disease might be related etiologically to pernicious anemia and reported 13 cases in support of this theory. Although definite colecystitis may occur in patients with pernicious anemia, this is not common in our experience as the incidence is probably no greater than it is in a similar age group without pernicious anemia. Likewise the sudden disappearance of symptoms in most patients following treatment suggests that the underlying pathology is a transient rather than a more or less permanent change such as a cholecystitis.

Any statement concerning the neurogenic origin of the gastrointestinal symptom in pernicious anemia must be chiefly speculative in nature at this stage of our knowledge. It is our impression that patients with advanced spinal cord lesions have a tendency to constipation and abdominal distention which may be on a neurogenic basis. Some of our patients with advanced subacute combined degeneration of the spinal cord have complained of numbness in the rectum and fail to have the sensation of an impending bowel movement, with resultant incontinence of feces. It is unlikely that changes in the spinal cord or the nervous control of the bowel is the sole cause of the gastrointestinal symptoms as these manifestations may be present without definite evidence of spinal cord involvement.

The final consideration deals with the possibility that the gastrointestinal symptoms are evidence of an intrinsic defect of the gastrointestinal tract, probably confined to the stomach which is the fundamental cause of the disease. Evidence in support of this theory may be summarized as follows:

1. The fact that an achlorhydria precedes the anemia, that it is practically always present at the time of the anemia and remains after the blood has reached normal limits.

2. The occurrence of a severe anemia after operative removal of the stomach. There are now a number of authentic cases on record[10,11] where this has occurred.

3. The occurrence of anemia in gastrectomized dogs as reported by Ivy.[12]

4. The remarkable experimental observations of Castle[13] which throw more light on the etiology of the disease than any other known studies. This investigator demonstrated that the action of normal gastric juice on beef muscle liberates a substance which is capable of relieving the anemia of pernicious anemia promptly in a manner similar to liver or desiccated stomach. From these statements it seems logical to conclude that some unknown change in the stomach results in a functional deficiency which is the fundamental cause of pernicious anemia.

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## DISCUSSION

Dr. Irving Gray: Several of our patients with pernicious anemia developed a symptom complex suspicious of coronary artery disease. In the last 6 patients studied, we have done repeated fractional gastric analysis and studies of the urinary alkaline tide and at no time have we found any free hydrochloric acid in the stomach (using all known gastric stimulants) nor have we found any change in the pH of the urine. In 3 patients with a rather marked and progressive pernicious anemia, we recovered neutral red in the stomach after the dye had been injected intramuscularly. After the bile present in the gastric contents had been removed, we acidified the filtrate with dilute hydrochloric acid and we thus produced a deep red color. In 1 patient, the gastric contents contained a great deal of the dye but no bile. Examination of these contents for pancreatic ferment showed them to be present. The finding of neutral red in individuals, who have pernicious anemia may be accounted for by the regurgitation from the duodenum into the stomach.

Dr. Smithies: I would like to know if any tests have been made upon the liver function, not only secretory but also the other functions of that organ. It seems to me that, aside from the dietetic test, we have never had any very efficient tests for these patients in order to guide our medical treatment.

There are sometimes instances of cancer of the stomach where the blood is typical for pernicious anemia. I remember of Dr. Frank Billings and Dr. Bevan holding, at one time, a borderline clinic, in which the purpose was to demonstrate the efficacy of splenectomy in the treatment of pernicious anemia after a long discussion, the surgeon opened upon a large carcinoma of the greater curvature of the stomach. One should always rule out carcinoma in instances of pernicious anemia, particularly when they seem of textbook type. I have never seen cord changes with cancer, and often their pressure is a most important differential sign.

Dr. Soper: I think we all agree with the doctor's conclusion, namely that liver treatment does not always clear up these cases. This is particularly true in regard to the cord symptoms. Quite often we note that the blood returns to normal but that the pains in the hands and feet and difficulty in walking are increased. We have found high vitamin feedings to be useful in cases of this character.

As regards achylia gastrica all the older gastroenterologists have had patients under observation for a long period of years, twenty-five or more, without the development of anemia or any serious defect in nutrition. The secondary anemia and malnutrition that sometimes occur in achylia gastrica may often be traced to a chronic catarrhal enteritis. Dr. Adolph Schmidt emphasized that the nutritional state of the achylia patient depends upon the integrity of the mucosa of the small intestine. The diagnosis of chronic enteritis is readily made by careful feces analysis.

Dr. Gaither: Years ago, I had the privilege and pleasure of hearing Dr. William Hunter deliver a most interesting and helpful lecture on pernicious anemia. In the course of his talk, he emphasized the importance of noting, from the patient's history and physical examination, a glossitis or sore tongue; very often he had noted such a finding, which preceded by as much as two or three years, definite evidence of pernicious anemia.

Several years ago, it was brought out in the examination of a patient who consulted me, that he was suffering from a sore tongue; the blood-examination was entirely normal, but I urged the patient to return from time to time for further blood-examination, and warned him of the possibilities of the case. Many months later, he presented himself, so changed that I did not recognize him, and upon examination, proved to be a typical case of pernicious anemia. I present this instance in order to emphasize, as did Dr. Hunter, the importance of observing the condition of the tongue, even in the absence of blood-findings which might be indicative of pernicious anemia.

Dr. Ivy: Are there any cases on record in which women, with pernicious anemia, have become pregnant?

Dr. Isaacs: There is one thing which surprised us very much, as we studied these cases, and that is the total change in the gastrointestinal symptoms, especially the change in the appetite which comes about within four or five days after taking the liver extract, or dried stomach. There is one sign which is almost certain to appear, and we have called it, somewhat facetiously, the "positive toast test"; some morning, usually about the fourth or fifth day after we have started this treatment, the patient will ask the nurse for an extra slice of toast with breakfast, and that same morning, we usually find a rise in the number of young red blood-cells. This occurs before there is an appreciable increase in the red-blood cell count.

You will recall that, in many cases, it is believed that this condition is caused by bad teeth, and many of our patients have had all of their teeth removed, and they were unable to make as good progress as the others. We feel that removal of all the teeth is a bad thing, and sometimes think that the symptoms are seriously accentuated by it, and we are inclined to believe that it is an additional factor in producing the digestive symptoms which we see, and which might not be so bad if the teeth were let alone.

As to the cause of the constipation when cord symptoms are present, we think it is probably related to a loss of the sensation. When these symptoms are present, we have a loss of sensation in the joints, a loss of sensation in the bones, and, probably, a loss of sensation in the intestines, so that the intestine is no longer able to feel the presence of the food or its contents, and therefore there is a stasis, with the production of constipation.

Cathartics which increase the intestinal bulk have no effect, nor have those cathartics which affect the sensation of the intestines. However, cathartics which act directly upon the muscles of the intestines will cause a movement promptly, such as, for example, pituitrin.

Dr. Lueders: I think it is generally accepted that anorexia, in pernicious anemia is important as a symptom, and I think that its disappearance, following the administration of liver extract, is due to its high content of vitamin B. I believe, also, that the severe abdominal pain which disappears, is influenced by the high B vitamin content.

I would like to ask Dr. Sturgis, in estimating the cord changes, what size tuning fork does he use to get the most delicate vibration sense?

Dr. Sturgis (*closing*): Dr. Gaither's point concerning a persistent glossitis has interested me very much. Any patient with such a complaint should be carefully observed from the standpoint of pernicious anemia which means that at least a careful study of the blood and a gastric analysis should be obtained. The glossitis may be the earliest symptom and occur at a time when the blood is normal; but if the patient is in the initial stage of pernicious anemia there will be no free hydrochloric acid present in the gastric contents. One characteristic of the glossitis is a tendency for it to appear periodically.

Now, as to the point about the vitamins. It is true that commercial liver extracts contain a large amount of vitamin B but I do not believe it is responsible for the beneficial effects which are produced in pernicious anemia. In the first place, striking results have been obtained in pernicious anemia by administering a highly purified extract which is free from vitamin B and, secondly, the feeding of vitamin B alone has no specific effect in pernicious anemia. It was suggested at one time that the increased appetite which followed the use of whole liver resulted from a lowering of the blood sugar but this is not so, as the appetite improves before a definite drop in the blood sugar can be demonstrated.

With reference to Dr. Ivy's question concerning pregnancy in women with pernicious anemia who have been restored to normal with liver treatment, let me say that I have not observed such a situation as a very large majority of patients with the disease are past the child-bearing age. I have heard of one patient who became pregnant after treatment with liver extract but I have not learned the subsequent history of the case.

It is entirely possible that some of the abdominal symptoms, especially those referred to the epigastrium, may be of an anginoid type, although in our experience they have not had the characteristics of this kind of pain. Dr. James B. Herrick of Chicago has emphasized the importance of anginoid pain in patients with severe anemia.

I am sorry that I cannot answer Dr. Smithie's

question as we have not carried out extensive tests for liver function in our patients. In a fairly large group we have taken *x*-rays of the gall bladder with the improved technique but we are unable to draw any definite conclusions from them.

We have been greatly interested in the differential diagnosis between pernicious anemia and cancer of the stomach. Ordinarily this is not difficult but occasionally an interesting situation arises. A few months ago, a man of middle age was admitted with a history of loss of weight, pallor and persistent vomiting. Physical examination disclosed emaciation and a striking pallor. There was a severe anemia which was typical of the pernicious anemia type. Gastrointestinal *x*-ray series gave the characteristic pictures of carcinoma of the stomach. Even though we concluded that the patient had cancer, it was decided to give him desiccated stomach as the peripheral blood was so typical of pernicious anemia. There was an immediate and striking response to the treatment and within a few weeks the blood was normal and the patient was entirely well. A repetition of the gastrointestinal series disclosed a normal gastrointestinal tract. The only conclusion which could be made was that the first *x*-ray studies were incorrect and that the patient had a true pernicious anemia. I think it is worth while, therefore, to try the treatment of pernicious anemia in any patient who has the picture of a primary anemia in the peripheral blood, regardless of the other findings.

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* Continued from p. 15.

# PUSH FLUIDS

## THE SURGEON'S POSTOPERATIVE ORDER*

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CHICAGO, ILL.

THE fear of dehydration has swept the country. Starting with treatment of dehydration fever of infants, followed by the recognition of dehydrated states before and after operations, and in infections, a universal use and frequent abuse of excessive fluid intake have become a routine practice in most hospitals. For some years I have been observing with interest the often useless and frequently harmful procedure of pouring solutions through various orifices into patients. Often the mechanics of water retention and water excretion are fully ignored and pathologic conditions are aggravated.

The movement of ingested water from the point of entry to the time when it is excreted through kidney, lung, intestinal canal and sweat glands is not easy to follow. There are many controversial points, which lead into the much discussed subject of edema. But there are certain simple, unassailable facts which are so often disregarded, that their emphasis here is perhaps not unnecessary.

Nature has provided safeguards against water intoxication[1] in man. The sensation of satiety, of fullness after moderate amounts of water, the regurgitation and vomiting after gastric distention, the diarrhea and diuresis which follow ingestion of large quantities all serve to maintain the excretion in balance with excessive intake. It must be remembered, however, that the helpless patient into whom fluids are forced through non-physiological channels and whose water excretion might be handicapped by cardiac, renal or some local factors, may very easily develop a positive water balance with such retention as may have serious consequences.

1. *The Cardiac Factor.* Patients with myocardial damage show the same diuresis as normals after fluid intake, so long as they are in a stage of compensation; however, as one of the early signs of decompensation the water excretion is delayed. Retention occurs during the day and during the night there is a characteristic nycturia. At the same time the increase of weight in cardiac patients between morning and night as Gönczy[2] showed, reveals a latent edema, which so long as the horizontal rest in bed helps to excrete it, disappears next morning. If decompensation is further advanced, the patient continues to put on weight from day to day and becomes obviously waterlogged.

So long as a patient is in the upright position, or sleeps in a chair at night, the edema shows in the dependent parts of the body. The fact that cardiac asthma frequently occurs in waterlogged patients when they lie down, leads to the assumption that pulmonary edema, because of an overloading of the pulmonary circulation, is a factor in the case.

It is undoubtedly possible in a surgical patient, whose cardiac insufficiency is barely compensated, to produce a decompensation with edema and dyspnea by forcing fluids. When the protective water-depot in the liver runs over, the pulmonary circulation is suddenly overcome with fluid. A case in point was seen some years ago.

A woman sixty-five years old had a thyroidectomy performed for chronic hyperthyroidism. She had myocardial damage and auricular fibrillation. Following thyroidectomy 7000 c.c. of normal salt solution were given daily subcutaneously and partly as a Murphy drip. She developed a pulmonary edema which was interpreted as postoperative bronchopneumonia and died on the fifth day with signs of cardiac failure. There was a marked decrease in urinary output. No autopsy was performed.

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It is hard to say how much the forcing of fluids had to do with the fatal outcome, but that it must have meant an increased load on the damaged heart, was shown by the edema and the gradually decreasing urinary output following operation.

2. *The Renal Factor.* It is generally known from the widely applied concentration-dilution test, that a large intake of water such as 1500 c.c. is followed normally by an increased hourly output of urine, with lowered specific gravity. In the presence of renal insufficiency, the hourly amount of urine will not rise to the same degree, and the specific gravity remains fixed. An isosthenuria as described by Volhard ensues. Obviously if fluids are pushed in a patient with kidney damage, water retention must result. And yet the practice of pushing fluids to an extreme in old prostatics, who have often an ascending pyelonephritis, in addition to their hypertension, nephrosclerosis and cardiac damage, is common enough.

A seventy-one year old patient with prostatic hypertrophy and 150 c.c. of bladder retention was admitted, septic and dehydrated. Suprapubic drainage was instituted, and an order was given by the urologist to give 4000 c.c. of normal salt solution a day. The patient's condition improved very rapidly, but on the fourth day the legs became edematous and uremic symptoms developed. Reduction of fluids promptly relieved the patient, who later made an uneventful recovery after a two-stage prostatectomy.

Water retention was probably due here to both cardiac and renal factors and possibly a third factor, which I will discuss under the next heading.

3. *The Salt Factor.* When patients with kidney insufficiency are given sodium chloride, sodium bicarbonate or other salts in doses of 15 to 20 gm. a day, their weight increases because of water retention. The degeneration of kidney tubules results in a diminished ability to excrete salt in larger quantity or higher concentration. The retained salt will cause under certain ion-concentrations a water retention. When we push fluids into a patient, we must decide whether we want to have it retained or excreted. The customary 4000 c.c. of normal salt solution a day represents 40 gm. of sodium chloride. This is at least twice as much as our normal daily intake of salt. Such medication will make the patient even more thirsty because of an elevation of blood chlorides. If fluids are given in greatly dehydrated patients with low blood chlorides and upper intestinal obstruction, the normal salt solution is rational. In other cases, however, the sole administration of salt solution easily leads to water retention, particularly if a degenerative kidney lesion will prevent a normal salt balance.

There is another important reason for not giving sodium chloride solutions in larger quantities. The sodium-calcium-potassium balance of the blood suffers by an overdose of the sodium-ion. As early as 1907 Rössle[3] described colloid changes in the heart muscle of patients who had received intravenous normal salt injections. Such injections accelerate metabolism, may cause glycosuria and fever, merely because of the excess of sodium in the solution. For this reason, it is advisable to administer Ringer's solution, which contains in addition to sodium, potassium and calcium in the same ratio as in the blood.

4. *Pathologic Changes in Tissues.* Following head injuries, there is a cerebral edema and a rise in cerebrospinal pressure. The importance of restricting fluids following head injuries has been recently stressed by Temple Fay.[4] Obviously such a condition calls for dehydration with 50 per cent dextrose or magnesium sulphate. Pushing fluids at the same time annihilates such an effect and is distinctly harmful.

W. H. S., aged twenty-six, healthy, vigorous male, sustained a head injury with temporary loss of consciousness but no clinical or *x*-ray evidence of a skull fracture. When brought to the hospital the patient seemed dazed but not unconscious, pulse 80, respirations 14. The blood pressure was 120/80. The attending

man made a lumbar puncture, following which the patient became brighter, and respirations rose to 26. Fluids were pushed by rectum and under the skin totalling 4000 c.c. of normal salt a day. At the same time 50 per cent dextrose solution was given intravenously. The patient relapsed into a semicomatose state for the next three days. When he was seen on the fourth day, a restriction of the normal salt solution to 500 c.c. daily with continuation of the hypertonic dextrose injections was suggested. The patient showed marked improvement and left the hospital in three weeks with no detectable residual symptoms, except a slight lag in the adrenalin curve.[5]

The beneficial effect of dehydration or fluid restriction in preventing or mitigating pulmonary edema is well known. That pneumonia is characterized by a marked retention of sodium chloride and binding of a great deal of fluids is evident. Postoperative atelectasis which, according to Brunn, occurs more frequently than is usually recognized, can be converted into a pulmonary edema.

The following case illustrates the possibility of harming pulmonary circulation, when it is already embarrassed by a massive atelectasis.

A patient forty-six years old had a smooth cholecystectomy for an infected gall bladder with stones. On the second postoperative day a sudden rise in temperature occurred, with physical signs of a massive lung collapse. As she did not retain anything by mouth, fluids were pushed by rectum and subcutaneously, totalling 4000 c.c. of normal salt solution. In spite of the fluid intake the urinary output did not exceed 500 c.c. a day, and an increasing liver dullness was noted. On the fifth postoperative day, the patient manifested a sudden attack of dyspnea, which persisted during the whole day. The attending men diagnosed pulmonary embolism. When I examined the patient at the end of the day, the dyspnea was diminishing, the liver dullness was decreasing and a sudden diuresis set in. Obviously the venous block mechanism of the liver had given way, flooded the right heart with blood and resulted in an overload of pulmonary circulation. That pulmonary edema could more readily develop in a previously atelectatic lung is a possibility. On the other hand, pulmonary congestion may favor pulmonary infarction.[6]

### THE NUTRITIVE VALUE OF FLUIDS

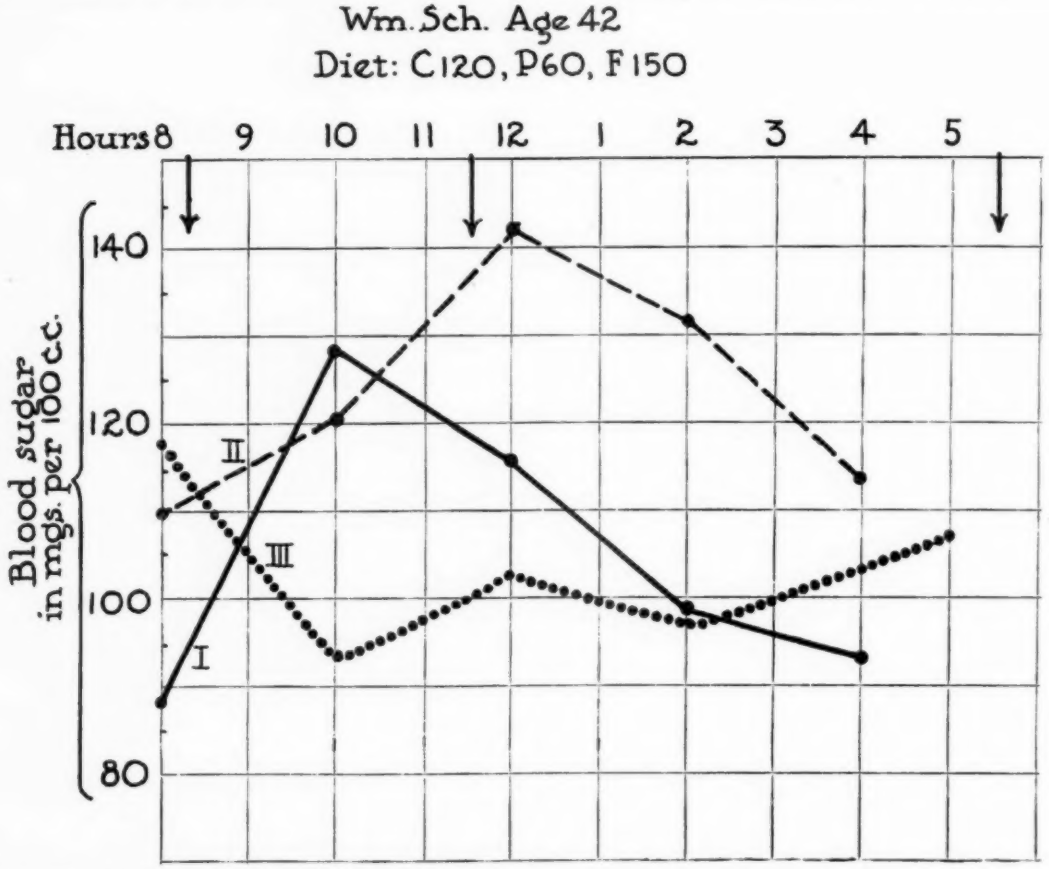
Many patients are unable to take anything by mouth after operation for several days. The consequence of such starvation is acidosis, with appearance of acetone in the urine. Administration of normal salt solution or even Ringer's solution does not improve acidosis. When dextrose is given in adequate amounts the glycogen storage of the liver is reestablished and acidosis disappears. The administration of dextrose solutions has been of great benefit and I feel, that as every operation, particularly under general anesthesia results in a temporary acidosis, the postoperative and if indicated the preoperative administration of dextrose solutions is advisable. It not only combats acidosis, but supplies calories. One hundred grams of dextrose can easily be given a day. Insulin does not seem necessary, unless the patient is diabetic.

### METHODS OF ADMINISTERING FLUIDS

Of the 3 customary methods of administration, namely subcutaneous, intravenous and rectal, the last named, in my mind is most open to criticism. In the case of dextrose, there is a grave doubt that anything is absorbed through the colonic mucosa. McNealy's experiments on dogs are extremely suggestive in this respect.[7] Objection must also be made of adding such an excellent medium as dextrose to the lower intestinal flora, where gas-forming bacilli are known to be abundant and increase distention. A controlled experiment is cited to show the effect of rectal glucose. (See Graph.)

M. Sch., aged forty-one, had been in the ward with a joint-mouse in the left knee joint (osteochondritis dissecans). He had never complained of any gastrointestinal disturbance and seemed to be in perfect physical condition. He was put on a diet of C120, P60, F150 and food was served at 8.15, 11.30 and 5.30. Three experimental periods were obtained. On the

first day the weighed diet was served and blood sugar determinations were taken at frequent intervals. On another day, all other conditions being equal, he was given 1000 c.c. of 5 per cent dextrose under the skin. On the third day, he was given 1000 c.c. of 5 per cent dextrose by rectum. Both subcutaneous and rectal drips were started at 10 A.M. and so regulated that they were completed at 1 P.M. From the table it will be seen, that on the control day, the breakfast caused the greatest fluctuation in blood sugar, but that the sugar level was fairly constant. On the second day, the subcutaneous dextrose gave a definite rise, two hours after it was started. On the day of the rectal drip, there was no elevation of blood sugar. The patient, however, became markedly distended, and it is possible that intestinal absorption was interfered with.




THE EFFECT OF SUBCUTANEOUS AND RECTAL ADMINISTRATION OF DEXTROSE ON THE BLOOD SUGAR LEVEL

Arrows indicate feedings at 8:15 A.M., 11:30 A.M., and 5:30 P.M. Curve I, straight line indicates blood sugar curve when diet of C120, P60, F150 was served and no dextrose was given. Curve II, interrupted line indicates blood sugar level, when patient received 1000 c.c. of 5 per cent glucose solution under skin. Same weighed diet was given. Curve III, dotted line indicates the blood sugar level when patient received 1000 c.c. of 5 per cent glucose by rectum. Both drips started at 10 A.M., and stopped at 1:00 A.M. Note low level of third curve indicating either a sudden mobilization of insulin, but more probably an interference with intestinal absorption due to distention.

This case illustrates a possibility of producing abdominal distention by the rectal drip with dextrose. Furthermore, as the blood sugar values did not rise after the rectal administration, as they did after the subcutaneous, there either was no absorption of the dextrose or there was such a rapid storage in the liver, that no excess of circulating sugar remained and utilization was increased. While this single experiment leaves room for both interpretations, it is very unlikely that such rapid absorption and utilization take place. In operating on diabetics, I have noted on two occasions, that whenever dextrose was administered rectally, and doses of insulin were given to help utilize it, insulin reactions occurred and the

insulin dosage had to be rapidly reduced, as the rectal sugar had not been absorbed and thus an excess of insulin was present.

Besides the probability that very little glucose is absorbed from the rectum and that colonic distention may be increased, a third factor speaks against the use of any rectal drip following abdominal operations. It is known that postoperative intestinal paralysis results not only in a distention of the bowel with gas, but in an accumulation of fluid. Following operations one can syphon off a considerable amount of fluid from the rectum. Obviously, when the bowel is distended, gases and fluids are not absorbed, as the venous backflow from the intestine is interfered with. To fill up such a colon with an additional 1000 or 2000 c.c. of tap water or normal saline solution does not seem logical. I believe that the extensive use of rectal drips has greatly contributed to postoperative abdominal distention, and prefer not to use it at all, if the necessary amount of fluid can be given through other channels.

### THE INTRAVENOUS ROUTE

Intravenous administration of fluids has much to speak in its favor. Its action is rapid and independent of the rate of absorption. When the circulation is depressed or the volume of circulating blood is diminished as in shock or hemorrhage, it quickly restores the necessary amount of fluid. There are nevertheless some drawbacks to intravenous administration. In the first place, reactions still occur in spite of the most scrupulous care in preparing the solutions and selection of tubing. Particularly the dextrose solutions may contain some protein, which produces typical parenteral protein reactions. I always use 50 per cent dextrose solutions from ampules, which are diluted in triple distilled water in 5 to 10 per cent concentrations. One to three thousand cubic centimeters of 10 per cent dextrose can be easily given intravenously during the day, and the dextrose thus administered is the best safeguard against acidosis.

One must distinguish between the dextrose solution given for dehydrating purposes, as in head injuries or acute pulmonary edema, and the dextrose which is given for purposes of utilization. In the first case, 50 per cent solutions are given, which start an intense diuresis, the dextrose being excreted with urine. In the second case, the concentration should not exceed 10 per cent, and the dextrose must be given so slowly that none is excreted. If the rate of utilization of dextrose given intravenously is approximately 1 gm. per kilogram body weight, per hour, not more than 65 to 75 gm. of glucose can be given in an hour. One thousand cubic centimeters of 10 per cent dextrose solution must be given in about an hour and a half, otherwise much of the ingested sugar will pass through the kidneys. One should always administer dextrose by an intravenous drip method. While I have only limited experience with Hendon's intravenous needle, his method of venoclysis[8] seems to fulfill all requirements of simplicity and efficiency.

When cubital veins are impossible to find, the saphenous vein might be helpful. But all these procedures, while simple enough in a large hospital with plenty of trained assistance, might become cumbersome and time-consuming elsewhere. Besides, the prolonged intravenous administration may favor thrombosis. I have used the saphenous vein of a diabetic child for four days, leaving in the needle continuously, without producing any thrombosis. Yet one cannot call this administration an ideal one, as a thrombosis could be precipitated.

I have left the simplest and safest method to the last, the subcutaneous drip which is simple to manage. If usual precautions of sterility are observed, and the ingested fluid is kept at a reasonable temperature, there will be no reactions. Three thousand cubic centimeters of fluid can be given, using the region under the breasts and thighs without any difficulty. If another 1000 c.c. must be given, and usually 3000 c.c. are plenty, it can be given intravenously. Of the 3000 c.c.

2000 c.c. are usually a 5 per cent dextrose solution, while the other 1000 c.c. are Ringer's solution. This gives the patient 100 gm. of dextrose and about 7 gm. of sodium chloride, which is usually sufficient for the first three days after operation. There are of course definite indications for more sodium chloride, as in high intestinal obstruction; it might also be necessary to restrict the salt to less than 7 gm. in certain types of kidney damage. It may be advisable to increase the dextrose intake for its nutritive value. But in the average major postoperative case, such quantities seem sufficient.

The great objection to subcutaneous drips, is the patient's discomfort. This is a very serious objection, even if otherwise the method is most simple and effective. One can and should anesthetize the skin with novocaine, use very fine needles, and change the needle's position frequently to avoid over-distention. The rate administration should largely exceed the rate of absorption. The dextrose solution must be 5 per cent, never more nor less and does not cause any tissue irritation. If for some reason the subcutaneous drip is not tolerated, there still remains the intravenous to use. Rectally only tap water is given, never glucose, and even that is avoided in abdominal distention.

The time to start liquids by mouth will vary according to the type of anesthesia, to the type of operation performed and postoperative complications. But when a patient is nauseated, or has vomited once or twice and shows increasing gastric distention, all fluids by mouth should be stopped and a permanent gastric drainage should be instituted with a Rehfuss tube, as outlined by Kanavel and Koch.[9] I have seen many a paralytic ileus recover under such management.

## COMMENT

The foregoing reflections barely scratch the surface of important problems. But it is time for the surgeon to approach the physiologically trained internist for more help in postoperative management. Most of these problems touch fundamental principles of circulation, kidney function, water and salt metabolism, tissue thirst, nutrition. Few surgeons could ever delve into such a maze of data alone. Joint clinical research with internists, who follow postoperative cases, would be highly desirable.

## RECOMMENDATIONS

Following a major surgical operation, which prevents oral intake of fluids for a few days, a satisfactory water balance can be maintained with 3000 and not more than 4000 c.c. of fluids. Most of the fluid can be given under the skin, but in the presence of serious complications, the intravenous drip method is useful. Rectally only tap water is given and even that only if no abdominal operation has been performed.

The solution preferred is 5 per cent dextrose under the skin, 10 per cent dextrose intravenously. For the salt balance, 1000 c.c. of Ringer's solution are used under the skin. In certain patients normal salt solution must be given in larger quantities, in others both fluids and salt must be greatly restricted. A senseless, routine, pushing of fluids may lead to conditions which Rowntree so concisely described in the experimental animal: water intoxication.

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# ELECTROTHERMIC HEMORRHOIDECTOMY*

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THE high frequency current (surgical diathermy) has become a valuable addition to the surgeon's armamentarium and is now used with success in a wide range of surgical procedures.

Among the conditions particularly suitable for surgery by this method are hemorrhoids. W. L. Clark[2] and others[3,5] have already described methods of procedure and reported series of cases treated either by electrodesiccation or electrocoagulation. The method here presented, electrodesiccation and excision of hemorrhoids by the monopolar high frequency current, is believed to be an improvement and to have many advantages over others in customary use.

*Preparation for Operation:* A mild cathartic is ordered the night before. If there is chronic constipation, as is usually the case, a sodium bicarbonate enema should be given two hours before operation. If, however, there has been a normal regular movement that morning, no further measures are taken. One hour before operation the patient is given 10 grains of barbital by mouth. This is routine as a prophylactic against the toxic effects of novocaine, following the suggestion of E. G. Martin.* To neurotic patients a preliminary hypodermic of morphine sulphate, gr. ¼ and atropine sulphate, gr. 1/150 is also given.

*Anesthesia:* Sacral anesthesia is ordinarily used. It is superior to local infiltration because (1) one needle prick only is necessary while local infiltration requires several needle insertions in a very sensitive area; (2) by the former method, the operative field is not distorted and the sphincter ani is not injured.

The injection completed and a dressing applied, the patient is immediately placed in the lithotomy position, properly draped, and perineum painted with iodine. This latter procedure is a test for anesthesia because a slight burning is complained of if anesthesia is not complete.

The anal region is inspected for pathological conditions and for relaxation of the sphincter. With the hands on either side of the anus, traction of the skin stretches the sphincter and everts internal hemorrhoids partially. A better view is also obtained of fissures, polyps, ulcers and other pathological conditions which may exist. The lubricated finger is next introduced into the rectum and the sphincter tested for relaxation. The anesthesia, if successful, causes complete relaxation of the sphincter, no movement of contraction is either observed or felt, and no resistance to divulsion is offered (Figs. 1 and 2). Indeed, divulsion becomes unnecessary with successful sacral anesthesia. Palpation further determines the presence of new-growth, polyps, indurated ulcers, etc. A Cook's rectal speculum is next inserted for examination of the rectum under direct vision. If indicated, proctoscopy is done.

*Equipment:* Any diathermy machine capable of delivering a steady spark ¼ in. long using the Oudin current is suitable. A machine equipped with Leyden jars is preferable because it delivers better and steadier currents for surgical work (endothermy). There is less tendency to char and the spark which is used for the work usually strikes where it is aimed. This latter characteristic is quite important in finer types of work. Bipolar current should not be used. In inexperienced hands, much damage may be done. *The monopolar current is sufficient for the removal of most*

* *J. A. M. A.*, 91: p. 555, 1928. "Ten grains (0.6 gm.) of soluble barbital by mouth given about one hour before operation will prevent the development of serious toxic symptoms in most instances."

* Presented with motion picture exhibition before the Albany County Medical Society, Albany, N. Y., May 15, 1928; the County Medical Society, Rutland, Vermont, November 27, 1928; and the Otsego County Medical Society, Cooperstown, N. Y., June, 1929.

*tumors the size of hemorrhoids and is practically foolproof.*

*Operation:* With an Allis clamp, the largest external mass is grasped above the mucocutaneous junction and pulled radially (away from the center of the anal opening). This causes partial or complete eversion of the internal hemorrhoidal mass which is usually found in the same radial plane, with perhaps a slight narrowing at the sphincter, the so-called externo-internal or combined hemorrhoids (Figs. 3 and 4). This internal component is now grasped with a second Allis clamp and drawn in the same direction as the first clamp. If the entire internal mass has not thus been drawn out of the anal canal, a third and even a fourth Allis clamp may have to be applied in the same radial plane as the first and second clamps and traction made outward until the entire mass is exposed. The hemorrhoid clamp is now applied to the base of this combined mass and locked (Fig. 5). The base is

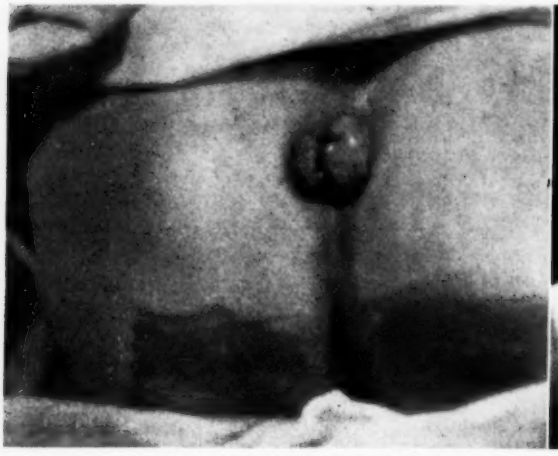

FIG. 1. Successful sacral anesthesia, sphincter relaxed and hemorrhoidal masses bulge outward.

FIG. 2. Completely relaxed sphincter easily divulsed by separating index and middle fingers.

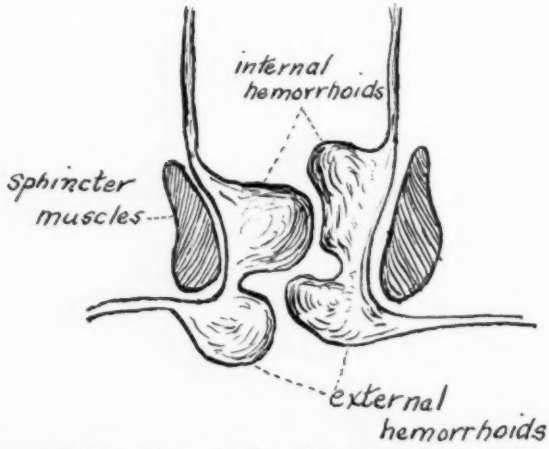


FIG. 3. Diagram in sagittal section of usual arrangement of combined internal and external hemorrhoids.

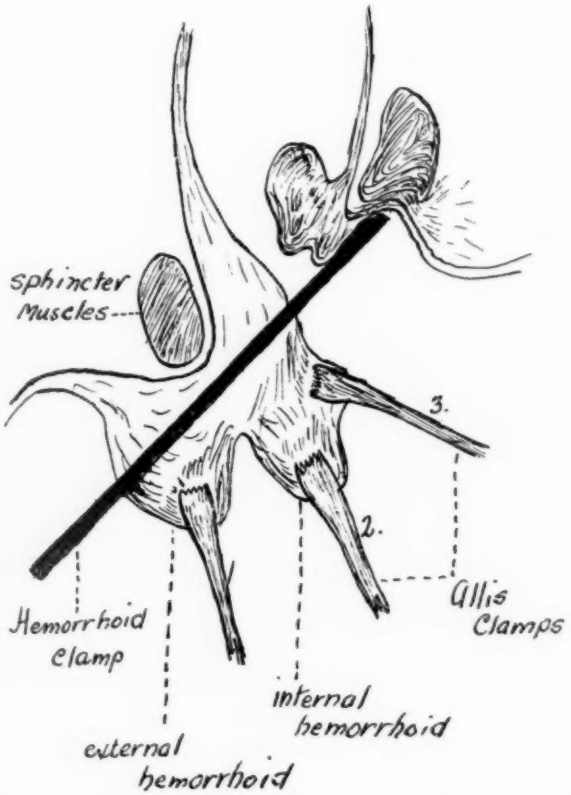


FIG. 4. Application of hemorrhoid clamp (represented by heavy black line) after masses have been pulled downward and outward with Allis clamps, care being taken to avoid the sphincter ani.

sometimes so long in its long axis as to occupy the entire length of the hemorrhoid clamp. A second hemorrhoid clamp may

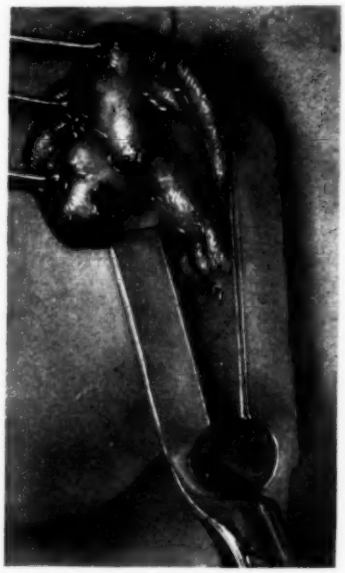

Fig. 5. Mass is grasped with Allis clamps and traction made radially. Hemorrhoid clamp applied to the base and locked.

even become necessary. Traction of the Allis clamps should be gently and evenly made; otherwise some of the innermost fibers of the sphincter muscles will be caught in the hemorrhoid clamp with resulting postoperative sphincteralgia.

A strip of sterile gauze is placed all around the clamp posteriorly, separating the clamp from the underlying anus and surrounding skin. The mass is now ready for electrodesiccation. The Allis clamps are removed and the needle electrode is applied to the mass, the current turned on with the footswitch while an assistant holds the hemorrhoid clamp. The entire outside of the mass is sprayed with the monopolar spark until it becomes gray in appearance. Then the needle is plunged into the mass at regular intervals, thereby desiccating the entire mass in a methodical manner (Fig. 6). Boiling fluid and steam, not smoke, will be seen coming from the tissues. Blood caught in the hemorrhoid will trickle out through the puncture holes made by the needle. The needle acquires from time to time a coat of coagulated blood or tissue, which must be scraped off; otherwise resistance to the transmission of current results in sparking from other parts of the electrode.

When the hemorrhoidal mass is dry, gray and shrunken in appearance (Fig. 7), it is cut off flush with the clamp (Fig. 8). This may be done with the scissors, which is preferable, or with the cutting current of Wyeth (Fig. 6). The stump is now

Fig. 6.

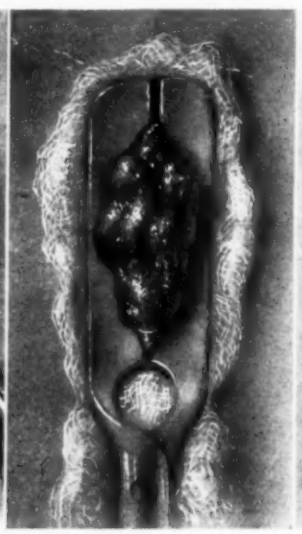

Fig. 7.

Fig. 8.

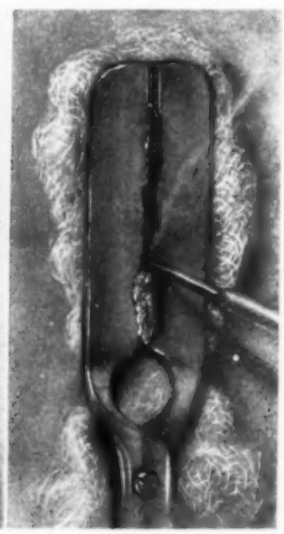

Fig. 9.

Fig. 6. Application of electrode to the hemorrhoidal mass using monopolar current.
Fig. 7. Shrunken appearance after complete desiccation.
Fig. 8. Mass cut off flush with clamp, leaving a desiccated stump.
Fig. 9. Stump of hemorrhoidal mass thoroughly treated with monopolar current until coagulated.

treated very thoroughly with the monopolar spark (Fig. 9). Not until the stump is thoroughly dry, almost charred, is the hemorrhoid clamp released, *only one notch at a time*, the stump being further desiccated as it is held between the blades of the clamp. Opening the clamp very slowly enables the operator to detect hemorrhage from poorly treated areas which can be controlled at once. The stump, it is to be remembered, is continuously under traction while in the clamp. Its sudden release causes the greater part of it to retract rapidly into the rectum. A hemorrhage, especially from the innermost ends of the stump, would at this time be most troublesome and should be avoided by the alternate one-notch release of the clamp and desiccation between the blades until it is evident that the stump is dry and clean. Should bleeding occur, it is treated by further desiccation after insertion of a speculum if necessary; or the bleeding point may be grasped with an artery clamp and coagulated. If it is properly performed, however, there should be absolutely no bleeding, even if the wound edges have separated. The author often deliberately separates the wound edges in answer to questions regarding the possibility of hemorrhage from such a mishap, but none but some negligible oozing occurs. The stump is then released and allowed to return into the anal canal (Fig. 10). Successively the other masses are similarly treated until all are removed, leaving a clean, dry field. Large and small external and internal hemorrhoids may now be removed reducing the chance of recurrence and preventing the formation of new hemorrhoids from small masses which at the time of operation by other methods are either overlooked or invisible because of the bloody field (Fig. 11).

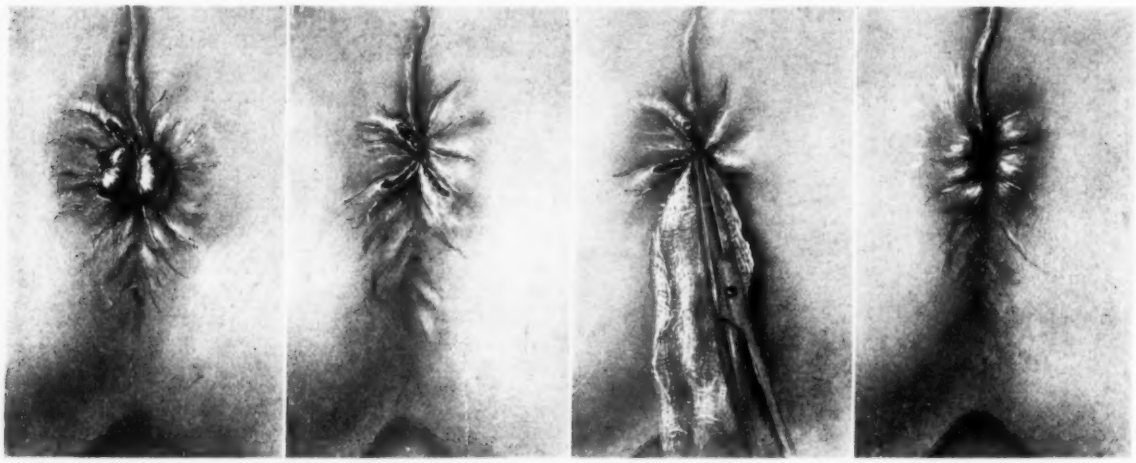

FIG. 10. FIG. 11. FIG. 12. FIG. 13.

FIG. 10. Stump released and allowed to return into the anal canal. Two more hemorrhoidal masses visible. These are treated in a similar manner.

FIG. 11. Operation completed, showing clean, dry stumps of excised hemorrhoidal masses.

FIG. 12. Inserting iodoform gauze impregnated with carbolated vaseline. It is pinned to the perineal dressing which is next applied.

FIG. 13. Appearance two weeks later, wounds entirely healed and covered with new mucous membrane. No scars visible. Operative field soft and piable.

Finally a small strip of iodoform gauze liberally impregnated with carbolated vaseline is inserted in the rectum (Fig. 12), the external end of which is pinned to several squares of gauze pressed against the anus. A thick pad followed by a T-binder is now tightly applied to the perineum.

The duration of the operation, depending upon the number of masses to be removed, is from fifteen to thirty minutes, occasionally longer. Toward the end of a long operation, most often after the

operation has been completed, a patient may complain of burning which may be slight, moderate or severe, indicating a return of sensation. This burning sensation is of short duration, rarely lasting for more than a half-hour and is quickly controlled by a hot water bag or an electric pad applied to the perineum as soon as the patient arrives home. If the immediate postoperative burning is severe, a hypodermic injection of morphine with atropine is given.

*Postoperative Care and Course:* The patient is kept in bed for two days but is allowed bathroom privileges. Normally, patients pass through a very comfortable postoperative period and in most instances are able to return to work or carry on their usual activities after the fourth day without the aid of any sedatives whatever.

Examination of the wound next day will reveal a remarkable absence of reactive inflammation. So little have the tissues been damaged that edema, swelling, tenderness or other evidences of operative trauma are rarely present. One can usually press his hand directly against the wounds without causing any pain. Occasionally one or more stumps will be found slightly inflamed or tender; but ordinarily no reactive inflammation should be found during the postoperative course, even when the patient, prior to operation, has had edematous, inflamed hemorrhoids.

Any time after the second day the coagulated stumps begin to slough slightly and separate from the underlying granulating base. From this time until complete healing takes place, about two weeks, there may be a few drops of blood in the stool, or the stool may be blood-streaked. The stool as it passes over the granulating wounds causes some bleeding usually negligible. It stops after the bowel movement and may not be noticed. *In over 200 cases there has never been a secondary hemorrhage and it is never to be feared if this technique is carried out in detail.* Approximately two weeks after operation the wounds are healed and covered with new mucous membrane. Scars are not visible and it is difficult to locate without careful search the sites of the excised hemorrhoids. The operative field is soft and pliable (Fig. 13).

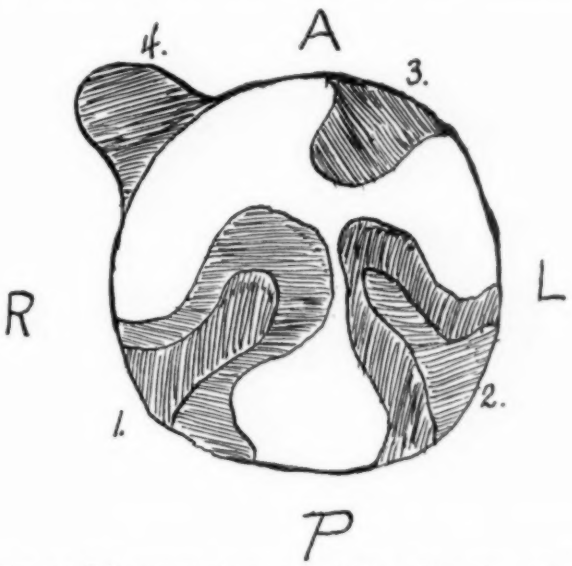


FIG. 14. Diagrammatic representation of location, type and extent of anal pathology, for use on patient's history sheets. R, right, L, left, P, posterior, A, anterior; 1 and 2, combined internal and external hemorrhoids; 3, internal; 4, external hemorrhoids.

A simple diagram is made on the patient's chart, showing the approximate locations and size of the hemorrhoids removed (Fig. 14). This chart has assisted materially in subsequent follow-up examinations. Should a patient return with more hemorrhoids, reference to the diagram indicates whether or not the mass or masses recurred in the operated area or have formed anew in areas not operated upon. The patient is not discharged until healing is complete and he is followed for one year subsequent to operation.

*Diet and Catharsis:* The patient is given a non-constipating diet upon leaving the office. After the second day one tablespoonful of an agar-oil mixture may be taken at night if necessary. After each bowel movement the anal region is gently washed with a sponge and warm, soapy water and carbolated vaseline is applied on gauze. It is desirable not to have a bowel movement until the third morning, thereby

permitting the operative area to rest. On the second postoperative day the iodoform gauze packing is removed. (The patient may have a natural bowel movement on the second day, passing the gauze spontaneously.) Usually, however, a dose of agar-oil mixture is necessary to initiate a bowel movement the next morning, and thereafter daily morning movements, usually painless, are to be encouraged. More than one movement results in tenesmus as the sphincter becomes too active and causes rectal pain in contracting. Cathartics or oil should then be discontinued. Tenesmus after bowel movement is controlled by heat (electric pad, hot water bag or hot Sitz bath). Rarely are sedatives required.

Insistance upon a non-constipating diet has been beneficial not only in assisting the cure of constipation but also in preventing recurrence of the hemorrhoidal condition.

## SUMMARY

Over 200 cases have been operated upon in this manner. Compared with other methods, the following advantages are claimed for it:

1. Under suitable circumstances, it may be done in the office.
2. There is no blood loss.
3. No complications such as fissures, ulcers, infections, abscesses, strictures, or loss of sphincter control have occurred.
4. No recurrences have been observed after this method was used during the past four years.
5. Convalescence is shorter and more comfortable. Total disability rarely exceeds four days.

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# HALLUX VALGUS*

## ITS CAUSE AND SIMPLIFIED TREATMENT

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THE purpose of this article is to show:

1. That hallux valgus is not an enlarged joint;

is the spring arch. In walking, the streams of weight-bearing (or moving load) travel through the foot in an *orderly manner*,

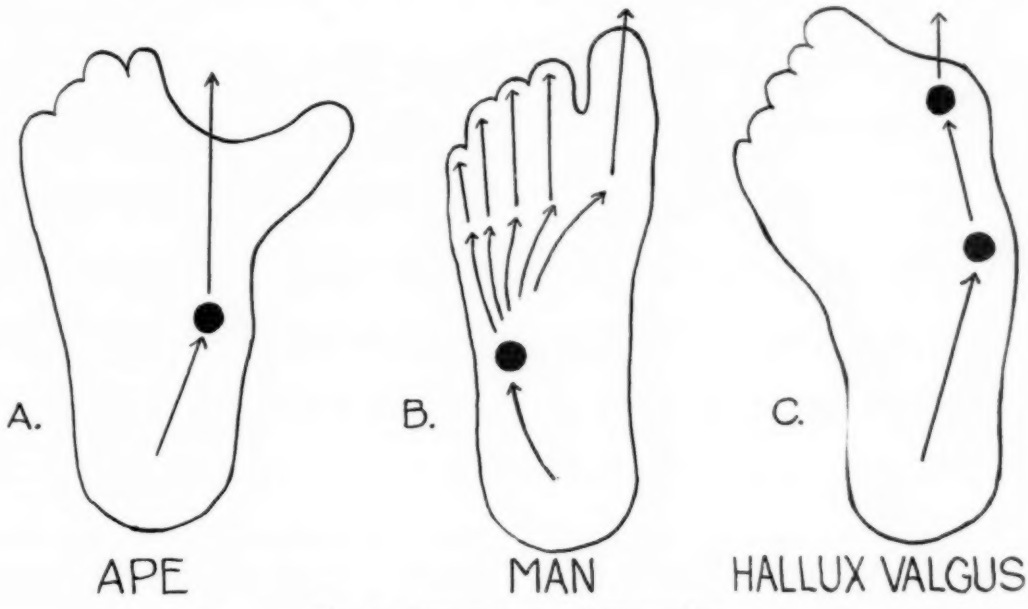


FIG. 1. A, ape; B, man; C, hallux valgus.

2. That broken arches and hallux valgus are the result of the same forces working on the foot;

3. That there is a phylogenetic set-up for hallux valgus;

4. That hallux valgus is the result of tendon imbalance across the great toe joint;

5. That hallux valgus can be corrected without removing the head of great metatarsal bone.

### ANATOMY

For brevity's sake, only the anatomy of the longitudinal arches will be mentioned. The outer one, composed of cuboid bone, and fourth and fifth metatarsals, is the main weight-bearing arch. The inner one, composed of scaphoid, cuneiforms, and first, second and third metatarsals, from the heel to the outer side of the foot, across the ball and through the toes (see Fig. 1, B).

### HALLUX VALGUS AND BROKEN ARCHES

Improperly proportioned shoes produce a disorderly irregularity of the distribution of the moving load. Figure 2 shows a foot imprint in relation to the insole pattern of an ordinary shoe. Point A is a fixed point ahead of the great toe joint caused by the cap or boxing; point B is a fixed point produced by the counter; and point C is a pressure point because shoes do not have enough room in them at this point, due to the failure of last makers to put enough wood in the last. Point C, working against points A and B, insidiously molds the foot out of line or in a position of eversion. I believe it is commonly accepted

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that eversion is an early step that produces unbalanced foot action and broken arches. This will disturb the distribution of the

Fig. 2. Foot imprint in relation to insole pattern of ordinary shoe.

moving load, resulting in foot strain because the weight-bearing will move mesially on to the spring arch (see Fig. 1, C.)

This vicious action of shoes not only throws too much weight on the great toe joint, but produces a mesially directed force, shown by the long arrow in Figure 2, which pushes the head of great metatarsal bone inward and off the foundation which is made up of sesamoid bones, muscle and fascia.

In the writer's series of 1812 cases comprising 3092 bunions, 60.3 per cent had everted feet, 32.4 per cent had drop of spring arch, and 82.1 per cent had malposition of arch bones.

## CAUSE OF HALLUX VALGUS

The phylogenetic development and the human anatomy of the great toe joint reveal the fact that there is nothing to resist this mesial thrust caused by shoes. Figure 4, A shows the structures below the great toe joint. *Note that all of the muscles are attached to the phalanges, distal to the metatarsal head.* Figure 3 shows the abductor hallucis and adductor hallucis in the monkey (macaque) A, chimpanzee B, ape C and man D. The macaque's foot has a strong adductor with which to firmly grasp a limb, the only function of the abductor being to pull the great toe outward for the next strong grasp. The chimpanzee spends most of the time in the trees and part of the time on the ground, the ape spends most of the time on the ground, and man all of the time on the ground. Note the gradual change of structure of the skeleton, with the retention of the same adductors and abductors. *But remember the adductor is by far the stronger muscle.* The black dots on these skeletons show the weight-bearing focus which is at the internal cuneiform bone in our progenitors (see side view of ape Fig. 3, E) as they do not have an arch. In this evolutionary development, suddenly an arch develops in man and the weight-bearing is focused at cuboid bone (see Fig. 1, B, and Fig. 3, D and F.)

Shoes evert the foot and throw the weight-bearing mesially, which is a *retrogression to primitive type walking*, although most cases maintain the arch thereby throwing the extra load on the great toe joint (see Fig. 1, C and compare it with Fig. 1, A). Shoes also destroy the function of great toe abduction; that is: no one who wears shoes can separate the great toe from the second toe as we pull the thumb away from the index finger. Newborn babes can do it and so can barefoot natives of South Africa. It is a well known fact in treatment of deformities that when one muscle loses its function through paralysis, the antagonistic muscle will pull the joint into a deformed position. Pulling across the great toe joint we have a strong adductor, and a weak abductor that has lost its function through the disturbing action of shoes. On top of this we have a mesial thrust from shoes which pushes the great toe joint inward. Figure 4, B

shows the result. The adductor pulls the great toe outward through its attachment to the proximal phalanx; the useless abductor tendon slides under the joint; and the great toe joint buckles over the top and mesially. The flexor brevis hallucis, whose double tendons contain the sesamoids, plays a secondary rôle, but pulls the outer sesamoid between the first and second toes. *Therefore hallux valgus is primarily a buckle joint and not an enlarged joint, the osteophytic outgrowth on the great metatarsal head and the inflamed bursa or bunion being secondary to irritation from shoe pressure, as the joint buckles with every step.*

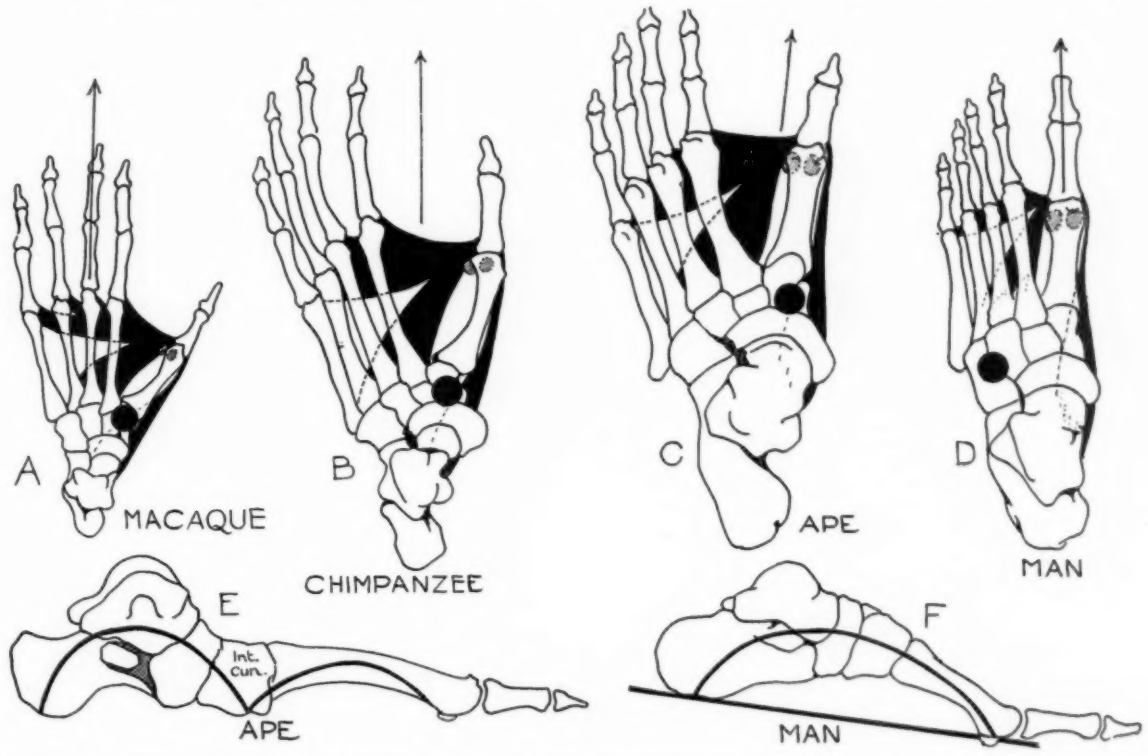


Fig. 3. Abductor hallucis and adductor hallucis, A, monkey (macaque); B, chimpanzee; C, ape; D, man; E, side view of ape; F, arch in man.

To sum up, hallux valgus is the result of:

1. Phylogenetically developed stronger adduction than abduction;
2. Tendon imbalance from lost abduction;
3. Joint buckling from mesial thrust of shoes; and
4. Excess weight-bearing from eversion of whole foot.

### VARIOUS BUNION OPERATIONS

With these causative factors in mind, it is easy to judge the efficacy of the various bunion operations.

The Heuter-Mayo method of amputation of the head of the great metatarsal and interposition of a flap, needs only be mentioned to be condemned. It not only fails to correct the tendon imbalance, but destroys the most important weight-bearing point in the front of the foot. The procedure is so radical that the foot may never readjust to the abnormal change. Fuel is often added to the flame by thus removing a weight-bearing point that is already carrying too much load, thereby causing increased foot strain.

The Keller method of removing the mesial half of the head of the great metatarsal is not quite so radical, but it does not correct the tendon imbalance and thereby does not relieve the buckling. However, those cases of patients unsuccessfully operated by this method can still be corrected by the overcoming of tendon imbalance.

The removal of a wedge of bone (cuneiform osteotomy) from inner side of meta-

tarsal head as well as cutting the outer ligaments of the joint capsule and overlapping the inner ligaments (Silver's method) attention to tendon imbalance, I cannot accept his theory. The removal of both sesamoids to cure hallux valgus does not

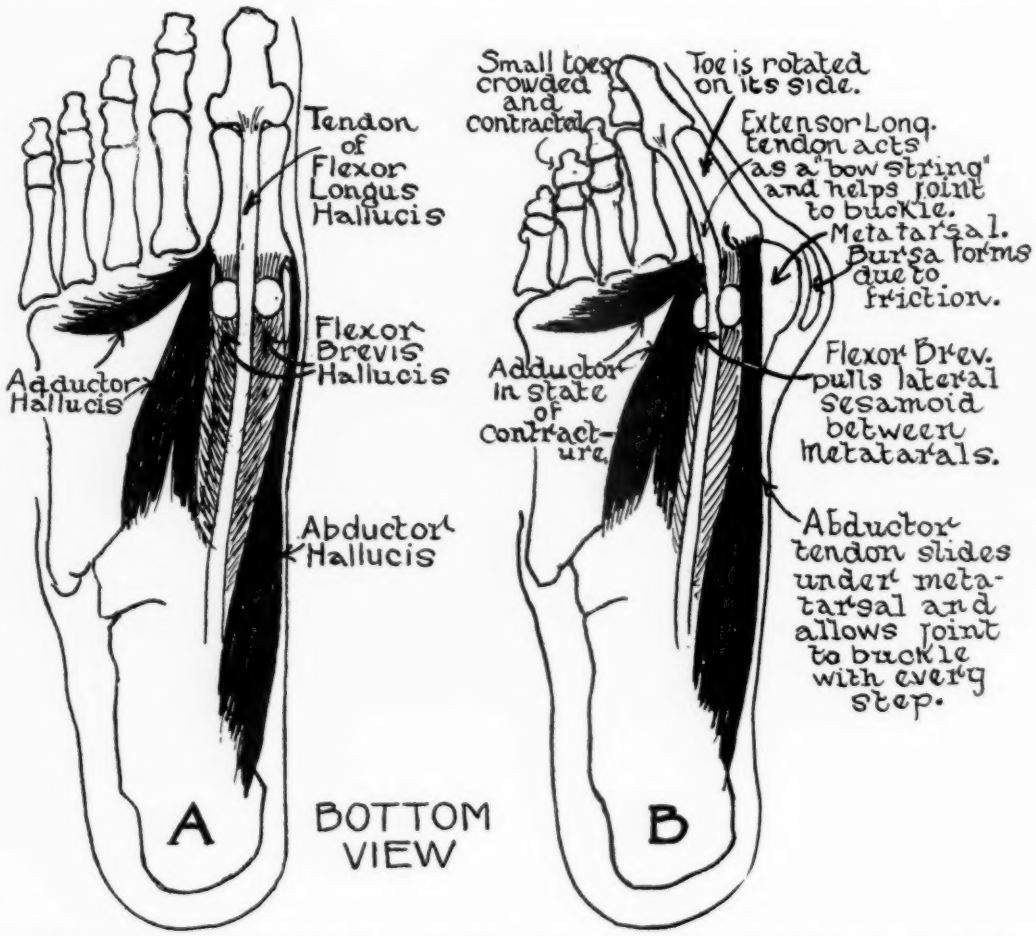
Tendon of Flexor Longus Hallucis
Flexor Brevis Hallucis
Adductor Hallucis
Abductor Hallucis
A
BOTTOM VIEW
Small toes crowded and contracted
Toe is rotated on its side.
Extensor Long. tendon acts as a "bow string" and helps joint to buckle.
Metatarsal. Bursa forms due to friction.
Adductor in state of contracture.
Flexor Brev. pulls lateral sesamoid between metatarsals.
Abductor tendon slides under metatarsal and allows joint to buckle with every step.
B

Fig. 4. A, Structures below great toe joint. B, mesial thrust from shoes which pushes great toe joint inward.

are theoretically unsound, as tendon imbalance and buckling still persist.

In 1911 Dr. Curtis Brigham removed sesamoids for hallux valgus, but later dropped the procedure. Since 1915 Dr. H. W. Robinson has been removing sesamoids also, and claims that all bunions are hereditary and that shoes never caused a bunion. The fact that hallux valgus is comparatively rare in men who wear sensible shoes, not only refutes the hereditary idea, but augments the argument that shoes are the immediate cause. His theory also claims that sesamoids push the head of great metatarsal mesially. In view of the facts brought out that sesamoids are only a secondary factor and that he pays no correct tendon imbalance, but is likely to produce an upward buckling of the great toe, because complete severing of both flexor brevis hallucis tendons is unavoidable (as sesamoids are imbedded therein), leaving the extensor brevis free to pull the proximal phalanx upward. In other words a dorsoplantar tendon imbalance may be produced, which is as painful as hallux valgus. Removal of both sesamoids leaves the flexor longus hallucis tendon unprotected, so this tendon flattens out and becomes adherent in the connective tissue mass in the deep fascia resulting from surgical trauma. Even though this procedure is unphysiological, it does not

destroy a weight-bearing point, and may reduce the severity of the buckling, although tendon imbalance still exists.

tenotomy is always done. Transplanting of the abductor tendon is done, without tenotomy, pulling it up to the normal

Fig. 5. Before and after operation by base correction method.

### Author's Method

The method devised by the writer, which he terms the Base Correction Method, has for its purpose:

1. To correct tendon imbalance;
2. To overcome joint buckling;
3. To strengthen phylogenetic weakness;
4. To place the metatarsal head on its base; and
5. To relieve excess load on the great toe joint.

In the first place there is no set orthodox technique that will meet the various complex situations met in the many varieties of bunions.

Arch treatment will aid in the proper distribution of the moving load and the writer prefers to do this by manipulation. This relieves the excess weight on the great toe joint.

To correct tendon imbalance adductor mesial position and suturing it to the periosteum of the great metatarsal bone. The mesial side of metatarsal head is denuded, thereby removing the osteophytic bone, and furnishing a bed for the re-location of the abductor tendon. Here we take advantage of the postoperative joint infiltration, which firmly anchors abductor to joint capsule and bone by a firm fibrous mass. This also overcomes the phylogenetic and shoe-acquired abductor weakness, and restores joint action without buckling.

In order to produce this restoration of tendon balance, other secondary procedures will have to be restored to according to the conditions presented by the type of case at hand. Intermetatarsal resistance, produced by tissue changes from the chronic nature of the deformity, must be overcome. So lateral capsulotomy may be necessary. Often interphalangeal

fasciotomy and skin lengthening are done. The malposition of the outer portion of the flexor brevis hallucis may require

Fig. 6. Before and after operation by base correction method. This patient walked four miles, three weeks after her operation.

tenotomy or lateral sesamoidectomy. Extensor brevis hallucis tenotomy may help, due to the angular pull of this muscle.

Restoration of joint alignment may be prohibited by an obstructing joint lipping on the mesial side of distal end of great metatarsal, which must be removed with the other osteophytic bone.

The closure involves mesial elliptical capsulectomy which not only removes the proliferating cartilage, but takes up capsular slack and strengthens the position of the imbedded abductor hallucis tendon. Skin closure involves elliptical removal of excess skin which not only removes the subcutaneous bursa (the bunion), but the painful callus also.

The writer has often said that foot surgery involves two main thoughts: (1) A thorough understanding of complex foot function; and (2) a deep appreciation of pressure points in shoes. The writer constantly checks joint function in making a choice of the combination of procedures to be used in an operation, and is always looking for bony prominences that may later cause shoe pressure. In closing this operation, he always looks for exostoses on the mesial wing of the base of proximal phalanx, on the superomesial aspect of the head of great metatarsal, and on the base of the sesamoid bones. If present they must be removed.

The work is all done under local conduction anesthesia, using a 1 per cent procaine solution. When tendon balance is properly restored the great toe will stand up in perfect alignment, without support, and the patient can flex and extend the toe before leaving operation room. Therefore no splints or casts are used. A soft surgical dressing is loosely applied, and a loose,

gauze-covered cotton pad is placed between first and second toes.

Stitches are removed in ten days and the patient is allowed to walk on the twelfth day. The feet are placed in shoes as narrow as we can get them into. The convalescent period is very short because normal function has been restored and no weight-bearing points removed. Figure 5 shows a case before and after operation by the Base Correction method. Dotted lines show the restored balance in tendons. The head of the metatarsal has not been removed.

## CONCLUSIONS

1. Hallux valgus is not an enlarged joint;
2. Hallux valgus is primarily tendon imbalance and joint buckling;
3. Phylogenesis plays an important predisposing rôle;
4. Shoes are the immediate cause of hallux valgus;
5. Broken arches and hallux valgus are the result of the same vicious forces;
6. Excess weight-bearing on the great toe joint can be relieved by treatment to the arches;
7. Surgery involves restoration of tendon balances, rather than destruction of weight-bearing points;
8. No set orthodox technique will cope with all varieties of hallux valgus.

# MECHANICAL DRAINAGE IN SURGICAL UROLOGY*

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DRAINAGE of the preoperative and postoperative cases has always been an important phase of surgical urology. This problem has been met in several ways, and the mechanical appliances that have been devised to handle it are numerous. Drainage of these cases requires, first, a classification as to the nature of the lesion, and secondly, a consideration of the mechanical environment under which the drainage must be carried on.

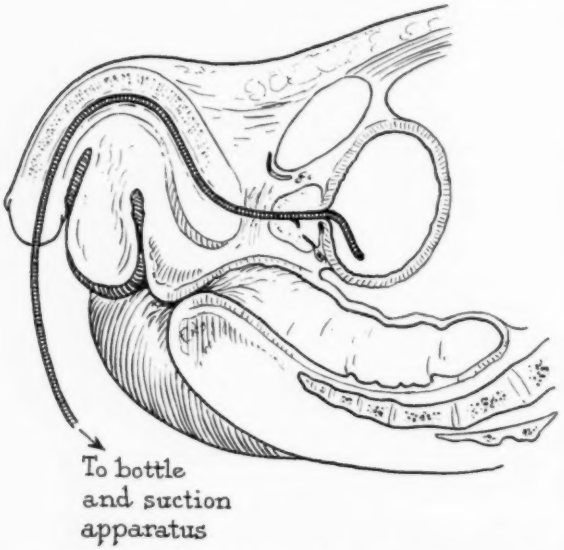


FIG. 1. Mechanical suction applied to indwelling catheter is extremely useful in preliminary stages of drainage if prostate is of type that bleeds easily, as a little gentle suction prevents clot formation, in the majority of cases.

Since the opening of the Squier Urological Clinic almost three years ago, there has been a constant stream of inquiries, written and verbal, from our many visitors and friends in this country and abroad, as to how the drainage problem is handled.

Prior to the opening of the Clinic, a variety of methods and apparatus had been tried, and many failures and changes marked the five years of experimentation which preceded the installation and adoption of the present system. Three more years elapsed before it was felt that the knowledge gained was of sufficient value to be given to our colleagues.

The apparatus and methods now in use have stood the test of time and of everyday use in a large group of rapidly changing cases. Improvements will be made, and there is a constant effort to make them; but the aim throughout has been to make use of the simplest apparatus and simplest forces available to produce the desired results. The force found to be best is gravity, and the substances used are water and air. Where necessary, though not as satisfactory, electricity is used. How the problem is handled will be shown in detail by drawings, photographs, and descriptions.

## THE SUPRAPUBIC GROUP

ONE-STAGE PROSTATECTOMIES, CYSTOTOMIES, BLADDER RESECTIONS. Prostatectomies make up the bulk of this group. Preoperative drainage is carried on in these cases by the use of indwelling urethral catheters, a tube leading from the catheter to a bottle hung in a sling on the side of the bed is the most satisfactory. The catheter is held in the urethra by adhesive tape and connected to the rubber tube leading to the bottle by means of a simple connecting tip. If the patient is ambulatory he may carry the bottle with him and place it in any position beside his chair. This is the simple case, and requires no aid to the force of gravity.

The infected case or one in which the prostate bleeds easily, forming clots in the bladder, is better handled if a slight suction is kept constantly in effect through the catheter. The suction must be just sufficient to keep the bladder empty and clean but not to collapse the catheter or draw the bladder wall into the eyelets of the

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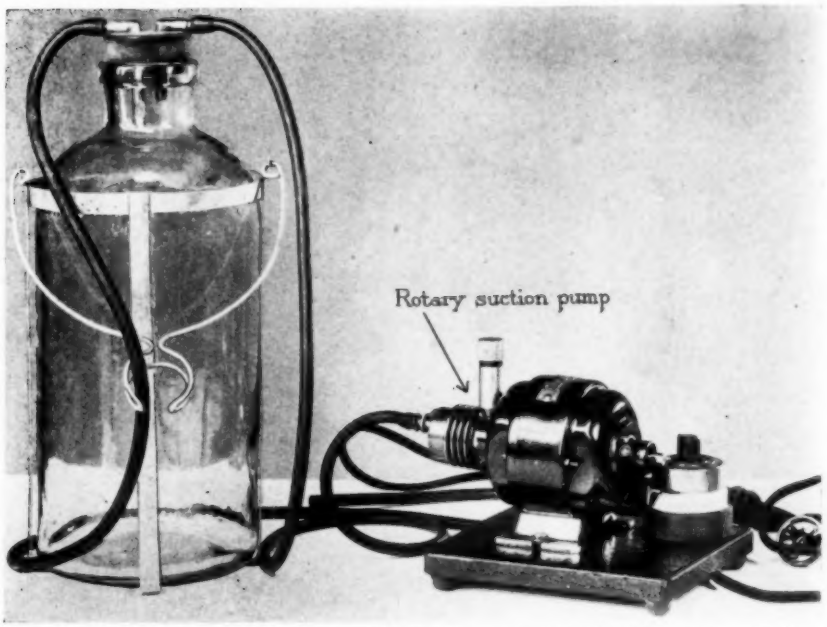


FIG. 2. Small alternating or direct current motor with rotary pump attached to motor shaft. A switch and rheostat are mounted in the base on which the motor stands. The weight of the motor, rheostat and switch is only 8 lb., and it occupies about 1 cu. ft. Bottle and sling are shown.

FIG. 3. Bedside application of electric suction apparatus. It is practically noiseless and the patient soon becomes used to slight continuous hum of motor.

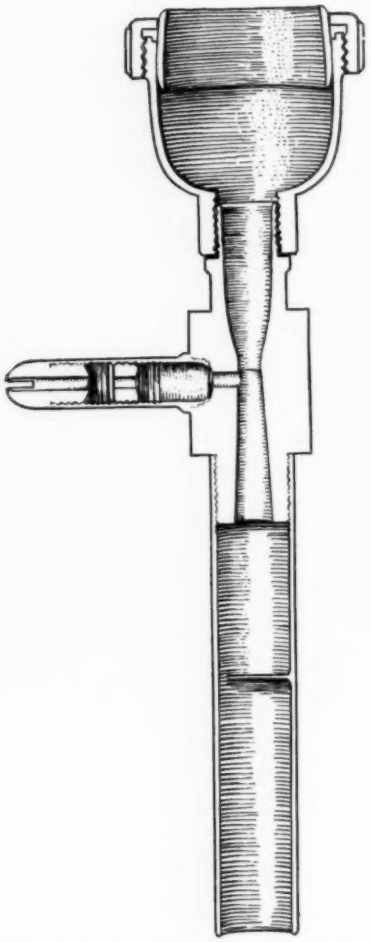

FIG. 4. Cross section of Chapman suction pump to show simplicity of mechanism. There are no moving parts to get out of order.

FIG. 5. Simple water suction pump attached in ordinary wash basin with rubber tube leading to patient's bed and larger rubber tube attached to outlet to prevent any noise or splashing. Whenever it is necessary to use the tap, this latter is easily removed.

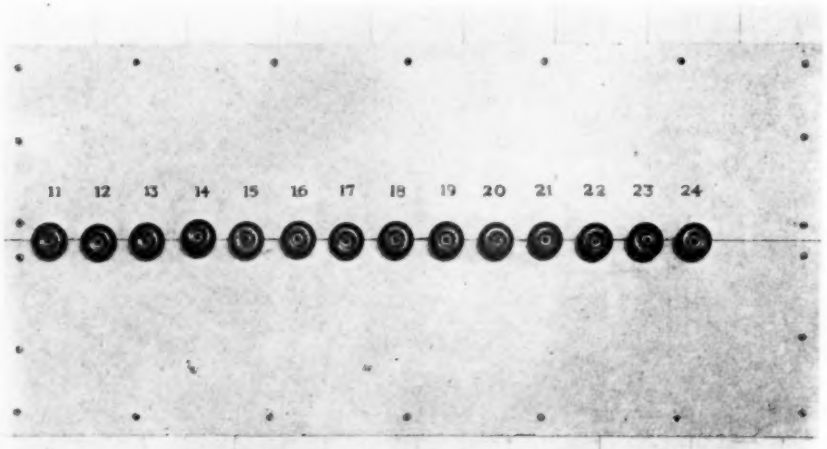


FIG. 6. Numbered hand controls corresponding to number on taps at beds. The suction pumps themselves are covered by plates, as shown, flush with the wall.

catheter (Fig. 1). How this suction may be generated depends entirely upon the mechanical environment of the patient; that

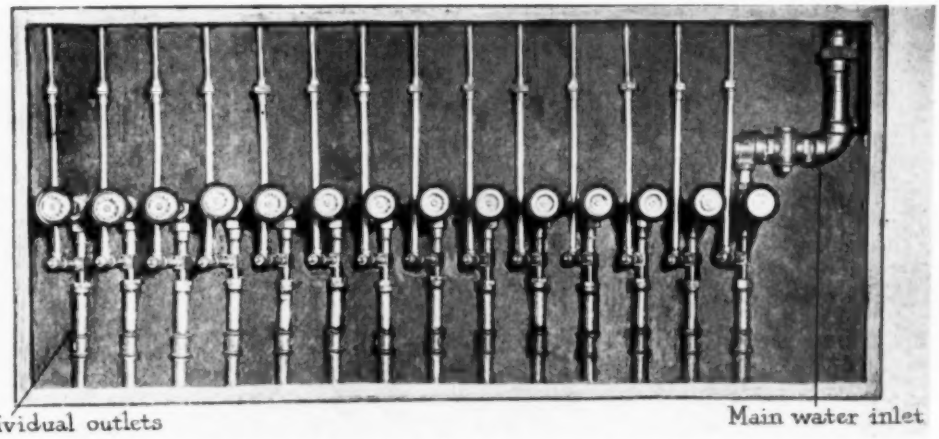


Fig. 7. Central suction station with a series of suction pumps placed in wall at central point.

is, whether or not there is running water available in his vicinity, whether there is available electric current, or whether

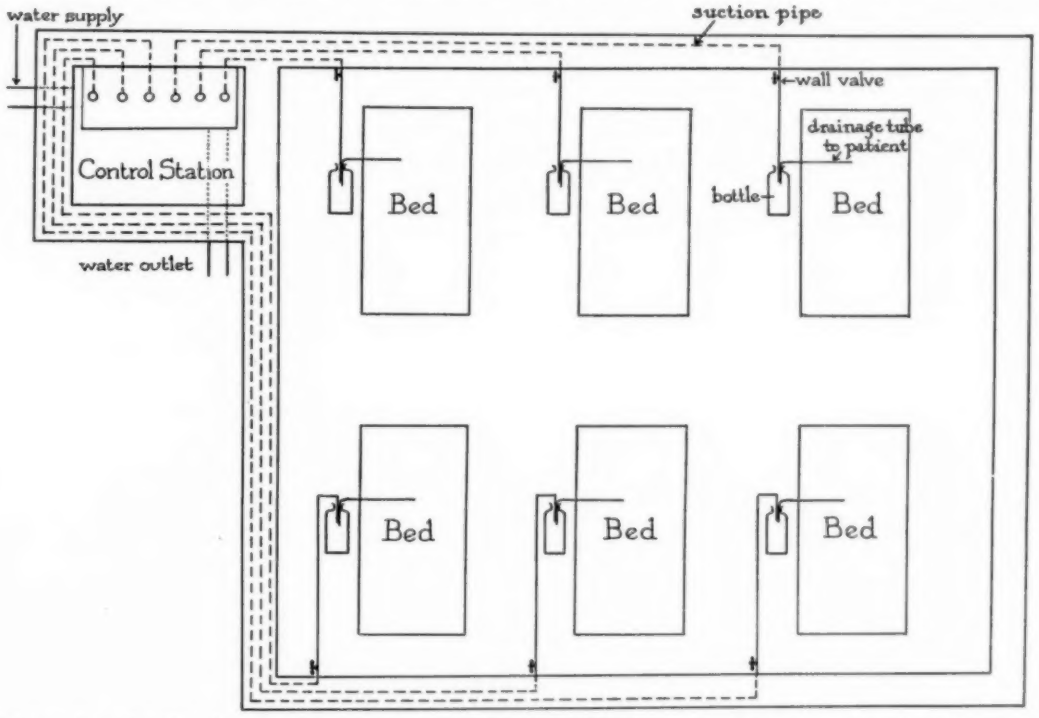


Fig. 8. Floor plan showing how water apparatus used in individual cases has been employed for large groups of cases by installing a series of suction pumps at a single point and piping to individual taps in the wall at the head of each bed.

there is an automatic drainage system, such as is installed in the wards of this Clinic.

Where electricity but not running water is available, as is the case in many hospital rooms and wards, a small motor operating on alternating or direct current and having a centrifugal pump mounted on its shaft and a rheostat under its base to regulate the speed and hence the amount of suction, has proved efficient; but it is inferior to the simple water suction pumps, which have been found, after several years of experimentation with all types of apparatus, to be the most satisfactory (Figs. 2, 3).

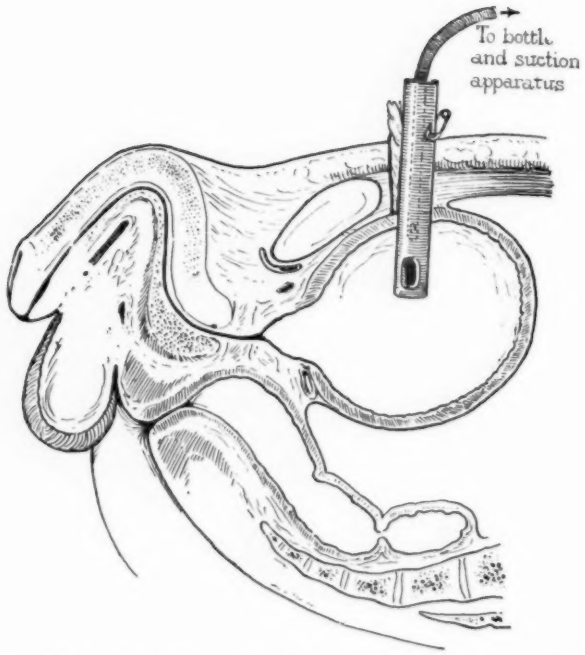


FIG. 9. Arrangement of Freyer tube and suction catheter immediately after operation, at which time suction is started. The cigarette drain is removed twenty-four hours after operation, and the tube and catheter on the fourth postoperative day; in cases of bladder resection on the seventh postoperative day.

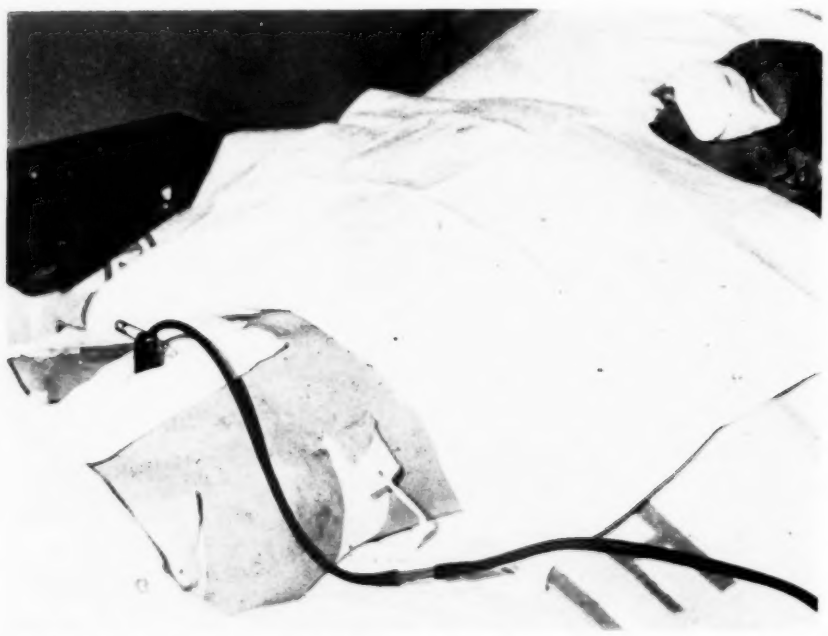

FIG. 10. Patient immediately after operation, the Freyer tube fastened in suprapubic wound, a catheter inserted in the Freyer tube, its tip just above the eyelets of the larger tube and held in place by a safety pin which is put through the walls of the Freyer tube only. Distal end of catheter is shown connected to rubber tube leading to drainage bottle. This connection is made with ordinary glass connection tip.

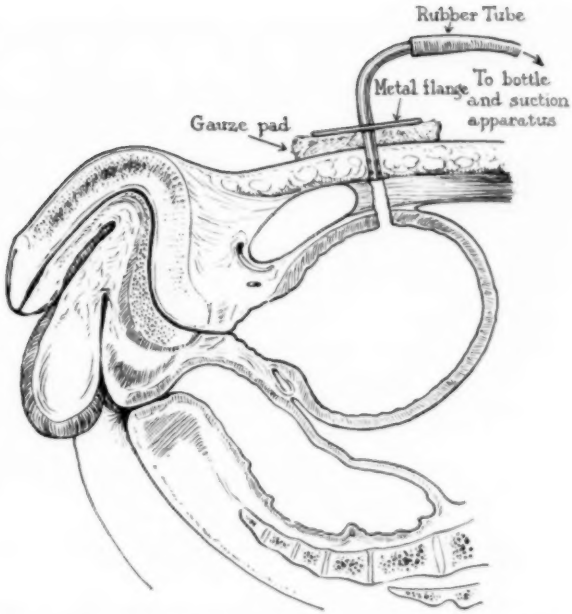


FIG. 11. Arrangement of suction apparatus after removal of drain (Freyer tube and catheter). Here is shown the Gile suction apparatus with a small gauze pad under the flange and the tip of the sucker no deeper than the skin level.

FIG. 12. Gile metal suprapubic suction apparatus. (For detailed description see *Surg., Gynec. Obst.*, 42: 713, 1926.)

FIG. 13. Complete water suction apparatus, suction pump attached to faucet, bottle, metal sling for hanging on bed, and Gile suction apparatus.

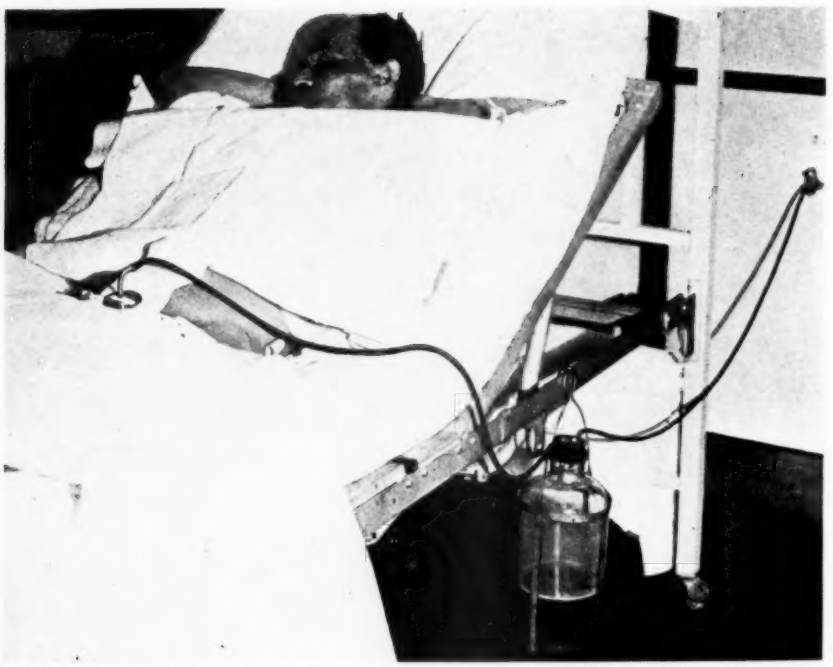

FIG. 14. Patient with Gile suction apparatus in prostatectomy wound, bottle in sling at bedside, and rubber connection leading to wall tap which is connected to central station in control room.

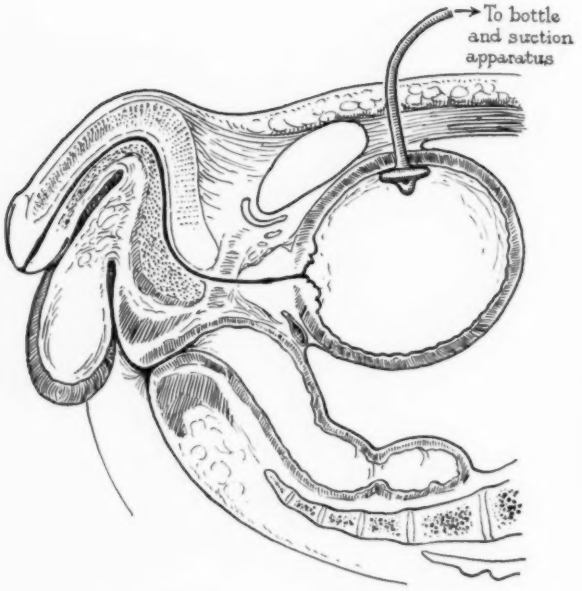


FIG. 15. Suction applied to mushroom catheter whether it be in a two-stage prostatectomy, in the simple cystotomy for malignancy, or in the terminal bedridden malignant case, insures a drier and more comfortable patient.

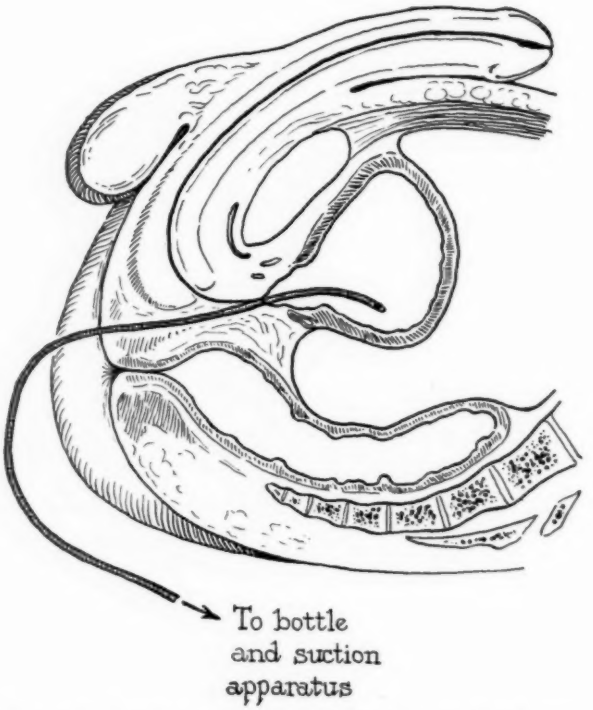


FIG. 16. Suction properly applied to perineal case whether drainage be through perineum or urethra insures a drier cleaner wound, takes care of any small clots, and saves dressings.

A simple Chapman suction pump is used and the amount of suction regulated by increasing or decreasing the amount of flow of water through the apparatus (Figs. 4, 5). If the water faucet is close to the patient's bed, the constant noise of the running water may be annoying, but this can easily be eliminated by attaching a short piece of rubber tubing to the pump and inserting it in the waste pipe below.

This type of apparatus is used on all cases occupying single rooms, and a multiple application of the same principle is used for the larger group of cases in the wards by installing a series of pumps at a central point and piping through the walls to individual spigots at each bed (Figs. 6, 7, 8).

Suction drainage is commenced on the one-stage suprapubic cases as soon as the patients are returned to bed from the operating room. A soft rubber catheter is inserted into the Freyer suprapubic tube and held by a safety pin placed through the tube but not through the catheter (Figs. 9, 10). The catheter is then connected with the suction pump by a glass connecting tip and rubber tube. This immediate application of suction does not increase any bleeding that may be present but tends to stop clot formation in the Freyer tube and insures a clean dry wound from the beginning. When the Freyer tube is removed, usually on the fourth day, a Gile metal suction disc is placed over the suprapubic wound, the suction tip extending just below the skin level, and drainage kept up through this as long as the sinus drains; i.e., until the patient begins to void (Figs. 11, 12, 13, 14). A suction apparatus of this kind does not slow up the healing of the wounds, as the suction chamber penetrates through the skin only. Large series of cases have been operated with and without the use of the postoperative suction, and the average time of healing has been found to be the same, the great difference in the two groups being that in the non-suction group the patient has been wet and miserable, and in the suction group, dry and comfortable, to say nothing of a very considerable saving of dressings, linen and nursing care.

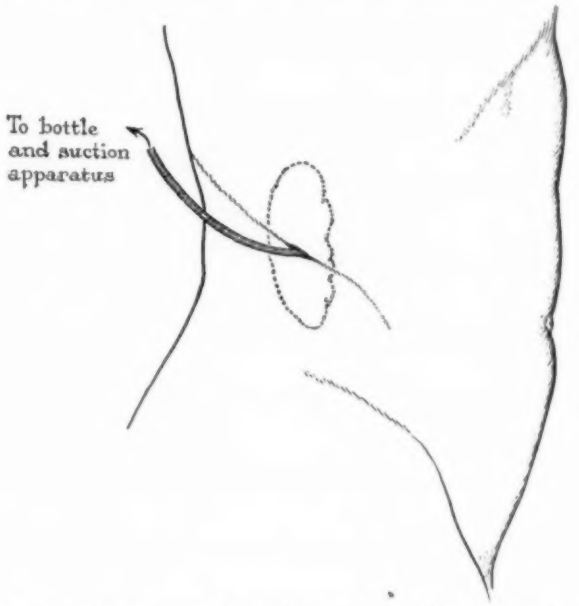


Fig. 17. Where it is desirable to keep kidney wounds open and where large amounts of urine or thin pus are discharging, mechanical drainage is very satisfactory.

Bladder Resection Cases. The bladder resection cases are handled, as far as the drainage is concerned, in exactly the same way as the one-stage prostatectomies. Drainage is started immediately after operation, but the smaller suprapubic rubber drainage tube is left in the suprapubic wound until the seventh or eighth day, at which time suction through the Gile apparatus is started.

### THE TWO-STAGE GROUP

This group of patients is divided into three classes: First, where the patient's condition is so poor, the kidneys and bladder so badly infected, that a two-stage operation is indicated. Such a case is drained by putting a Freyer tube into the bladder through a cystotomy wound and arranging the suction for four or five days as in the first group. After a preliminary period, a large mushroom catheter is inserted and suction kept up until the second operation seems advisable (Fig. 15).

In the second class of cases are the pa-

tients who have had a preliminary suprapubic operation done elsewhere and in whom a sinus is already present. Either a Gile suction apparatus or a mushroom catheter works quite satisfactorily with these.

Perineal Wounds. The perineal cases are drained preoperatively, as are the suprapubic ones, that is, through the sinus made by nature, the urethra. Postoperatively, the suction apparatus is applied to the perineal tube and the patient kept dry and his bed clean until the perineal tube is removed. If a urethral catheter has been inserted at the time of operation, gentle suction applied through it results in a cleaner and drier perineal wound (Fig. 16).

### DRAINAGE OF PYONEPHROTIC AND HYDRONEPHROTIC KIDNEYS

Removal of such lesions is of course preferable in one operation, but when the condition of the patient is such as to make preliminary drainage necessary, suction applied after the insertion of the drainage tube has been found to result in a drier, more comfortable patient and a cleaner wound (Fig. 17).

### SUMMARY

Mechanical suction applied to wounds draining urine results in:

1. Cleaner wounds, more comfortable patients, less nursing care and a tremendous saving of expenditure for dressings and laundry.
2. Mechanical difficulties are practically non-existent when water suction is used.
3. Water suction, where it is available, is the cheapest from the standpoint of power and apparatus, and is the most highly satisfactory.
4. Suction by means of electrically driven rotary pumps is next in simplicity and results, though considerably more expensive and subject to more mechanical hazards.
5. The various types of gravity apparatus have been found, in this clinic, to be cumbersome and unsatisfactory.
6. There is no delay in healing when suction is applied, often an increase because of cleaner wounds.

# CONGENITAL HYPERTROPHIC URETEROPELVIC OBSTRUCTION*

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CHARLOTTE, N. C.

IT is quite natural to designate those conditions as congenital which appear in the early years of life and whose underlying pathology is obscure.

Hydronephrosis resulting from true congenital obstruction of the ureteropelvic junction is exceedingly rare. Although a number of such cases are reported, the etiology is usually found to be, upon close scrutiny, not congenital in origin but the end-result of an infection in the wall of the ureter.

Since hydronephrosis is caused by mechanical obstruction to the outflow of urine from the pelvis of the kidney, ureteral blockage from any cause will produce it. The more frequent causes of this obstruction are:

A. *Aberrant Vessels:* The recent literature has been filled with descriptions and pyelograms of hydronephrosis caused by aberrant vessels passing across the ureteropelvic junction and causing a blockage with a resultant distention of the pelvis.

B. *Abnormal Kidney Motility:* It seems that the pendulum regarding kidney motility is gradually swinging back to a sane view of the subject. With the introduction of upper tract diagnosis, and the enthusiasm of the earlier workers upon the subject, the medical profession passed through a phase during which all movable kidneys were suspended and fixed. The operative procedure was to such an extent misapplied and so many kidneys were suspended through error in diagnosis, that the operation gradually came into great disrepute. Finally, it fell into the class of "meddlesome surgery."

With the refinements of modern technique that are now employed, such as pyelograms in the horizontal and upright position, serial pyelography and other procedures to determine the emptying time of the kidney pelvis and the routine employment of ureterograms, we are beginning to find that in certain selected cases kidney fixation is clearly indicated and produces excellent results. It is important in discussing renal motility that we should bear in mind the fact that a hydronephrotic kidney is a heavy kidney. Thus the increase in weight may be a predisposing cause of abnormal motility.

C. *High or Oblique Entrance of the Ureter into the Kidney Pelvis:* The ureter normally leaves the kidney pelvis at its most dependent portion and in this way gravity assists in the downhill drainage. If, however, the ureter passes out from the mid-portion or the upper half of the kidney pelvis, the drainage of the urine from the dependent calices is naturally uphill. Under such circumstances the musculature of the kidney pelvis works under the same strain as the bladder does when the vesical neck is pushed upward, and an analogous condition is produced. We are all familiar with the rapidity with which urinary obstruction develops if an abscess or neoplasm pushes up the region of the internal sphincter and thus creates a dependent non-draining bas-fond in the bladder. In those kidneys in which the ureter enters from the mid-portion or higher up on the kidney pelvis the residual urine of the kidney pelvis slowly and gradually increases. With this increase in weight there is a tendency to descent in the kidney. As brought out by Kelly and Burnam,[1] if the ureteropelvic junction be fixed, the lower pole of the kidney will rotate inward using the fixed point of the pedicle as its axis of rotation. Therefore, with the descent of the kidney there is a

* Submitted for publication June 16, 1930.

corresponding ascent of the ureteropelvic junction; thus, more mechanical obstruction to the outflow of urine is produced.

Fig. 1. Hydronephrosis of right kidney in six-year old child, due to hypertrophy of smooth muscle of ureteropelvic junction. Before operation.

This ascent of the renal pelvis accounts for the ureters which at operation are seen to emerge from the uppermost point of the hydronephrotic pelvis.

D. *The Congenital Hypertrophy of the Circular Layer of Smooth Muscle at the Ureteropelvic Junction:* The normal ureteral wall consists of an outer fibrous layer, a central thick muscular coat and the mucous membrane lining the ureteral canal. The muscular coat is composed, in turn, of smooth muscle and is divided into three layers. The outer and innermost layers have their smooth muscular fibers running parallel to the course of the ureter.

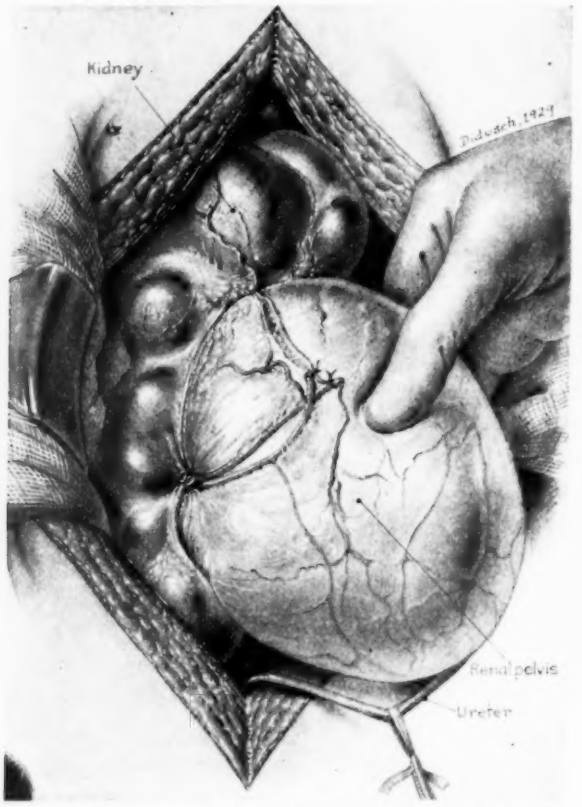


Fig. 2. Kidney seen through transperitoneal nephrectomy wound. Posterior peritonem has been opened, ascending colon and intestines have been packed out of operative field. Note that the ureter is normal below ureteropelvic junction, also great dilatation of vessels over hydronephrotic pelvis.

The middle muscle fibers are circular in their arrangement and their fibers pass around the ureter instead of up and down its wall. There are three points in the ureter where the middle circular layer of fibers reach their greatest thickness. These are: the ureteropelvic junction, the point where the ureter crosses the large vessels of the pelvis and the ureterovesical junction. Those who manipulate stones in the ureter are well aware of their decided tendency to become arrested at these three points.

If in the formation of the embryo the middle circular layer becomes abnormally hypertrophied, we have a condition of the ureteropelvic junction that is quite analogous to congenital hypertrophic pyloric

stenosis, which frequently is met with in the newborn.

It is with the hope of stimulating interest in the early recognition of this condition of childhood that the following case is reported. Early recognition before the destruction of the kidney has taken place would certainly be amenable to plastic surgery of the renal pelvis.

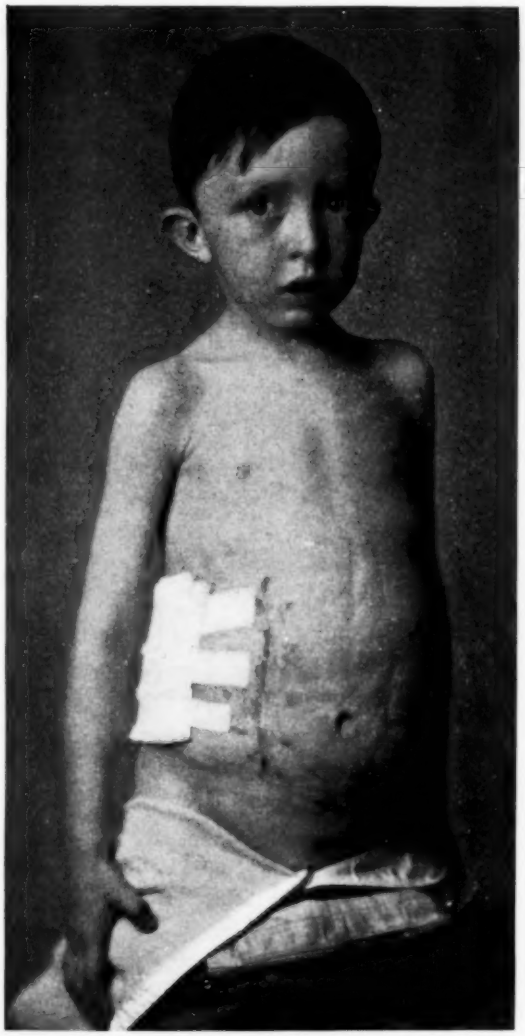

Fig. 3. Child fifteen days after operation, showing abdomen returned to normal and healed transperitoneal nephrectomy wound. Dressing is over stab wound in lumbar muscles where drainage tube was brought out.

R. H., aged six, male. The patient was referred by Drs. E. P. Brunson and B. T. Talley of Albemarle, N. C., to Dr. Addison G. Brenizer, Charlotte, N. C., who was kind enough to help us with the operative procedure. The patient's complaint was a mass in the right side.

*Family History:* The family history was negative. His mother and father were living and well. There were two other normal brothers and sisters.

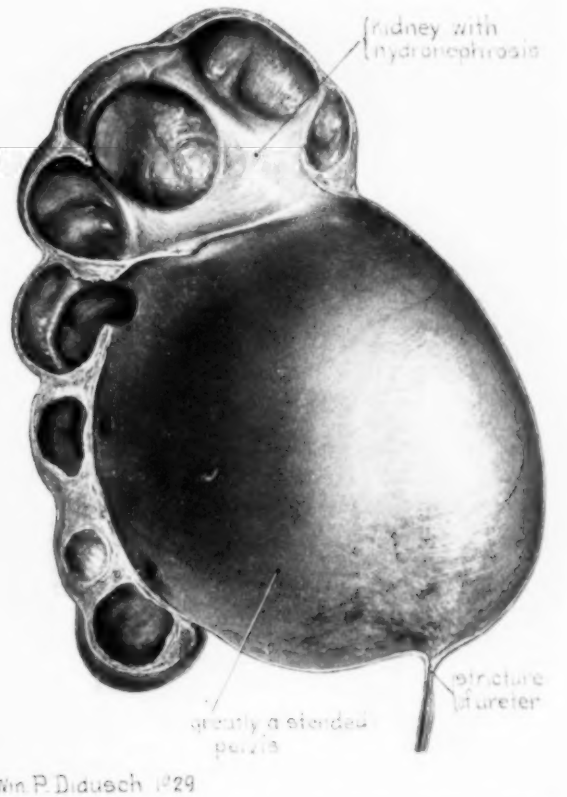


Fig. 4. One-half of hydronephrotic right kidney. Kidney parenchyma has been totally destroyed, save for a small remaining area in lower pole. Kidney, after operation, distended, held 1500 c.c. of fluid. Note great thickening of wall of ureteropelvic junction. This is caused by hypertrophy of circular musculature of ureteropelvic junction. Note also that lumen of ureter below this point is normal.

*Past History:* His past medical history was negative. At four years of age he was operated upon for appendicitis. He had measles, also, at four years of age.

*Present Condition:* The parents noticed that from time of birth, the child's abdomen was, apparently, larger than normal. It finally assumed the enormous proportions that existed on his admission (Fig. 1). There had been no headaches, or dependent edema. His appetite was good, he had had no gastric or intestinal upset, and had not lost any weight.

*Examination:* Temperature 98.6, respiration,

20, pulse, 70, Wassermann test was negative. White blood corpuscles 13,000, Red blood corpuscles, 4,800,000, Hb 66 per cent (Sahli).

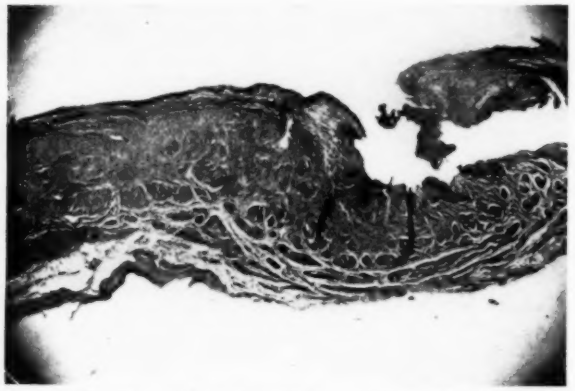

FIG. 5. Section taken through ureteropelvic junction. External and internal longitudinal muscle coats are of normal thickness. Tremendous hypertrophy of circular middle coat is very plainly visible. Portion of mucosa and underlying tissue has been torn up by artifact in right upper corner of section. No replacement of muscle by fibrosis or other evidences of infection in section.

Differential count polymorphonuclear 81 per cent.

The patient had great difficulty in walking due to his protruding abdomen. Recently the intra-abdominal pressure had become so great as to produce shortness of breath. The examination of the head and chest revealed normal findings.

*Abdomen:* The abdomen was very large and pendulous. The skin over it was quite tense. There were dilated venules over the costal margin with evidences of collateral circulation. There was made out over the region of the right kidney a very large movable mass that could be very definitely outlined; it was about the size of a normal adult head. It was not painful to pressure or movement. It was definitely fluctuant upon ballottement. A tympanitic note was present over the mass due to the intestines being pushed forward. The outline of the left kidney could not be made out. There was no free fluid or shifting dullness made out in the abdomen. The genitalia were infantile but normal in configuration.

*X-Ray:* Plain *x*-ray revealed no stones in the urinary tract. The left kidney shadow was larger than normal in proportion to the size of the child. The right side of the abdomen was covered by an indefinite shadow that evidently was fluid.

*Cystoscopy:* A child cystoscope entered the bladder easily. The study of the bladder and trigone was negative. A No. 4 catheter was passed up the right side but did not obtain any urine. Normal urine was obtained from the left kidney.

*Laboratory Examination:* Urine from left kidney showed specific gravity 1.024, 1 to 2 pus cells per high-power field. Culture of the urine from the left side showed no growth after twenty-four hours' incubation.

Urine from the bladder showed specific gravity 1.020, albumin, plus, glucose, negative, bile, negative, acetone, negative. Urine sediment showed 5 to 6 pus cells per high-power field, occasional casts.

Blood group No. 2 (Moss).

*Intravenous Phthalein:* Three minutes' appearance time. First half-hour 20 per cent, second half-hour 17 per cent, third half-hour 8 per cent, fourth half-hour 6 per cent to 51 per cent total for two hours.

A diagnosis of hydronephrosis of the right kidney was made and it was determined to do a transperitoneal nephrectomy.

*Operation:* The patient was draped for a right upper quadrant incision. An incision was made in the outer border of the right rectus muscle from the costal margin down to 3 cm. below the umbilicus. The bleeding points were clamped and tied with zero catgut. The rectus muscle was pushed over to the midline and the peritoneum was opened. The large tumor presented itself in the right flank with the ascending colon lying over it. The peritoneum over it was opened and the large pelvis of the hydronephrotic kidney became visible. The vessels over it were greatly enlarged. Due to its enormous size a trocar was introduced and 500 c.c. of clear urine were aspirated from the kidney. This greatly relieved the intrarenal tension and facilitated the isolation of the pedicle. The pedicle was doubly clamped, divided, and doubly ligated with No. 3 chromic catgut. It was then quite easy to separate the kidney from the surrounding structures (Fig. 2). The ureter was freed about 3 cm. below the ureteropelvic junction. It was not enlarged, its walls were not thickened and apparently was normal below the point of constriction. It was clamped, divided, and tied with No. 2 chromic catgut. A stab wound was made in the lumbar muscles and a tube sewed in place for drainage of the cavity from which the kidney had been removed. The incision in the posterior peritoneum was then closed with No. 1 plain

catgut. The abdominal wound was then closed. The anterior peritoneum was closed with No. 1 plain catgut. The muscles were closed with No. 2 chromic catgut. The skin was closed with interrupted sutures of black silk. No drainage was brought out of the anterior wound.

The child stood the operation well, and he was not shocked as a result of the procedure, probably due to the slow release of tension with a trocar. He left the operating table in excellent condition. His postoperative convalescence in the hospital was entirely uneventful. The wound promptly healed and he was discharged fifteen days after operation (Fig. 3).

About two weeks after his discharge from the hospital, he had an acute attack of tonsillitis and returned with symptoms of acute nephritis. He was treated medically for this and his symptoms quickly subsided; he was again discharged from the hospital.

He returned to the hospital six months after his operation in excellent condition.

*Pathology:* The pathological specimen consisted of a very large hydronephrotic right kidney. When refilled with fluid the kidney and pelvis held 1500 c.c. of urine. The specimen was split in half down through the ureteropelvic junction (Fig. 4). There was present great venous distention of the vessels lying over the pelvis. The parenchyma of the kidney was completely destroyed except for a very small remaining bit in the lower pole. At the ureteropelvic junction there was a very marked thickening of the wall of the ureter. Below the ureteropelvic junction the ureter was not distended and its wall was of normal thickness. Sections taken from the kidney showed complete destruction of the normal kidney elements. A section taken from the ureteropelvic junction (Fig. 5) revealed the ureteral wall at this point to be composed of greatly hypertrophied smooth muscle fibers. These were circular in arrangement. There was no evidence of past infection, infiltration with lymphocytes, or fibrosis present. The outer longitudinal muscle coat was normal, as was also the submucous longitudinal coat. A part of the mucous membrane in the section was broken by artifact away from the underlying structures.

*Conclusions:* True congenital hypertrophy of the circular muscle layer of the ureteropelvic junction has been infrequently reported.

Most of the so-called congenital ureteropelvic strictures are inflammatory in origin and are not caused by muscular hypertrophy. Sections of these strictures usually show lymphocytic infiltration and fibrous tissue repair of the normal structures.

Due to the fact that the underlying pathology is not caused by infection in such cases, but is a congenital abnormality, in their early stages they should respond to plastic operations upon the ureter and pelvis.

As in the aforementioned case, after destruction of the kidney has occurred, nephrectomy is indicated.

[1] Kelly and Burnam. Diseases of the kidneys, ureters and bladder. N. Y., Appleton, 1922.

[2] Geraghty, J. T., and Frontz, W. A. A study of primary hydronephrosis. *J.* of *Urol.*, 2: 161, 1918.

# NON-OPERATIVE EXTRACTION OF URETERAL CALCULI*

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THE etiology of ureteral stone has, during the past decade, received a considerable amount of attention, but before the advent of the operating cystoscope and the present methods of pyelography with non-toxic opaque media, the causative factors which operated to produce these concretions were but dimly understood, and the ordinary location of the stones was so inaccessible even to radical surgery, that the whole subject remained almost hypothetical.

But as soon as modern instruments and radiologic observation could be applied to this especial aspect of urologic surgery, the majority of these obscurities were rapidly cleared up. A number of investigators, notably Hunner of Baltimore, scrutinized the ureter and gave us a world of information concerning its history and pathology so that most of the theories previously held had to be abruptly discarded, and speculation was replaced by scientifically conducted research. Hunner's work has centered especially upon ureteral stricture, and it is the existence of this condition which, in his opinion, is responsible for the vast majority of ureteral calculi.

At the very beginning of the present century, Rovsing, the late great Danish surgeon, wrote quite extensively on the subject of ureteral stone. These concretions he divided into two classes: (1) Those which form in the kidney and being expelled into the ureter, lodge in some portion of this duct; and (2) those which arise primarily in the ureter "because there has been caused a stasis of the urine by some type of stricture, perhaps a congenital valve formation, or again, because of a suppuration or ulceration due to the presence of the tubercle bacillus or some other inflammatory agent." It was Rovsing's contention that a deposit of hard particles from the urine may be due to the presence of such an inflammatory process, which thus provides a nucleus about which calcareous deposits may gather. Either intra-ureteral or extra-ureteral factors may serve to induce stone-formation. In the first classification are the congenital valve formations and the inflammatory conditions already mentioned; in the second are tumorous growths or disease of the surrounding tissue. Once the calculus is formed, its presence will be evidenced by a wide variety of symptoms, but it is beyond the scope of this paper to undertake any discussion of these.

*The Problem:* Once the diagnosis has been made, we are confronted with the problem of removal. No less an authority than Braasch of the Mayo Clinic has stated that:

> In all probability the majority of stones in the ureter pass spontaneously [and he cautions that] while no rule can be adopted, it would be rational in the great majority of cases, to wait at least two or three months until Nature has made several attempts to dislodge the stone. On the other hand, repeated violent colic, the danger of renal destruction, and other complications as the result of an obstructing stone may necessitate its removal before this period has elapsed.

The enthusiasm for operative removal of calculi lodged in the ureter has been steadily waning throughout the past two decades. As long ago as 1910, Deaver pronounced the open operation for the removal of a stone lodged far down in the ureter as having potential difficulties second to those of no other abdominal operation. Bransford Lewis, in 1912, gathered the histories of a number of cases where this operation was attended by very grave consequences, and Tenney some years earlier, in 1904, studied the mortality attending

* Read at the Academy of Medicine Oct. 21, 1929, before the Association of Italian Physicians of America.

this type of intervention and found it to be from 15 to 20 per cent. These figures have, fortunately, been much improved during the past twenty years, but the hazards still remaining are great enough to give us reason to avoid open operation whenever the removal of these calculi can be accomplished by any other means. The non-operative measures which are available in all but a few cases, may be listed as follows:

1. Catheter manipulation and ureteral dilatation, with or without the use of forceps.
2. Fulguration.
3. Injection of sterile oil or glycerine.
4. Incision of the ureteral orifice.

*Catheter manipulation* or the "teasing of a stone out of its niche with a catheter when hung in the ureteral orifice" has been possible since the invention of the operating cystoscope, but it is a method which can be successfully applied only to very small stones located near the vesical orifice. Dourmashkin states that he has frequently been able to overcome an obstruction caused by the presence of a stone in the ureter by the use of large-sized olive or even round-tipped catheters (Nos. 8 to 12 Charriere) and thus pushed the stone upward into the renal pelvis with comparative ease, "when catheters of small caliber and filiform bougies failed to accomplish this purpose. . . . In one instance the stone was carried at the tip of the catheter from its lodging place 2 cm. above the ureteral orifice to the pelvis of the kidney." When the stone has once been pushed up it has a tendency to drop down to the original site of obstruction so that this operator found that:

> Whenever it is possible the best procedure in the treatment of non-impacted ureteral stones is to attempt to push up the offending agent into the dilated portion of the ureter by the use of large-sized catheters (7 to 11 Charriere) and immediately dilate the portion of the ureter below the stone by tapering ureteral bougies . . . 2 cm. long and tunneled to allow introduction of lubricants.

At the Mayo Clinic it has been observed that many stones if dislodged by a ureteral catheter will later on be passed spontaneously. "The stone becomes lodged in the ureter and subsequent colics may make its anchorage in the mucosa firmer. The passage of the ureteral catheter dislodges the stone, changes its axis, and the next colic forces it out."

Buerger passes several catheters into the ureter, and if he succeeds in getting them past the stone, leaves them there for some hours so that they may have time to become agglutinated to the stone. In this way he has on a number of occasions been able to withdraw the catheters with the stone attached through the bladder and into the urethra.

*Dilatation of the Ureter:* If carefully and persistently carried out, dilatation will serve to get rid of the great majority of ureteral calculi. Caulk attempted this method of relief in 96 cases, failing in only 8, which is certainly a gratifying small percentage. He dilated the vesical end of the ureter by the use of bougies up to size No. 11 French, still larger ones being used in a few instances. The bougies were sometimes left in place for a number of hours, or even over night. Lewis has devised a set of instruments for use with his operating cystoscope, the shafts of which are made flexible to permit of their use at an angle "around the corner" as well as by the direct method, and similar equipment now accompanies most of the standard cystoscopes. The practice at the Mayo Clinic is to forcibly dilate the stricture below the stone in the hope of being able to grasp it with forceps when its position has been altered.

A method of dilating the ureter by means of rubber bags has lately been put forward by Dourmashkin. By it he claims to be able to accomplish dilatation of the ureter to almost any desired size, and to dispense with the bulky ureteral dilators which necessitate the slitting of the meatus in many instances, besides requiring the highest kind of manual dexterity which often cannot be commanded at any cost. In

order to insert the bag easily, he has found it necessary to plan a modification of the present model of the cystoscope ordinarily used, but in the instrument so modified, its use is simplicity itself, and he believes that intra-ureteral manipulation of calculi will be greatly facilitated by the employment of this device.

While concurring in the opinion that many cases of ureteral calculi should be treated conservatively, Bugbee, addressing the American Association of Genito-Urinary Surgeons a few years back, emphasized how greatly the judgment of the individual surgeon must be relied on to decide what is the best course in any given case. For example, a calculus impacted in a ureter with a hydronephrosis above, should be removed by operation, unless it can be at once dislodged by manipulation, and the same is true when the kidney above is infected and symptoms of septic absorption are present. Yet this author has found that the simple shifting of the axis of a small calculus by manipulation with ureteral bougies or catheters, or sometimes retention for twenty-four hours of the ureteral catheter which has been slipped by the stone, aided by the propulsive force of the urine, and the enlarging of the ureteral orifice with a cut at its superior margin with the fulguration wire, is all that is needed to secure passage of the stone in nearly all cases.

During the war period, Bugbee published two papers in which he made mention of an ingenious method of extracting ureteral calculi which appears to have served him well on numerous occasions. By boiling the catheter or bougie it may be rendered soft enough to pass through almost any kink or coil about a calculus, and may thus be made into a loop, which can be thrown around the stone and thus serve to withdraw it as in a sling. The catheter is twisted in the fingers and gentle but firm traction applied.

*Fulguration:* This has been successfully employed by numerous writers, and is in use under certain rather restricted conditions in most of the prominent urologic clinics. By this agent the less dense stones may sometimes be disintegrated, and in those cases where it is found necessary to wound the ureteral wall, the fulguration spark will be found useful for the control of bleeding.

*Injection of Oil and Local Anesthetics:* Some years ago, Crowell of North Carolina injected 2 c.c. of 2 per cent solution of cocaine at the site of an impacted stone, simply for the purpose of relaxing the muscular fibers and lessening the pain attendant upon an effort to remove the obstruction. The resulting relaxation was so marked that within three minutes a catheter was easily passed beyond the stone. After the injection of 10 c.c. of sterile olive oil, the catheter was removed, and the following day the stone was found in the bladder. The following technique was worked out as a result of this event, and put into practice at the Crowell Urological Clinic.

A roentgenogram is made of a No. 5 bismuth-filled catheter passed into the affected ureter until it meets with resistance. The *x*-ray picture gives further evidence of the size and location of the stone, and if urine flows from the catheter it demonstrates that the obstruction is not complete and the kidney still active. Two cubic centimeters of a 2 per cent solution of cocaine are then slowly injected at the site of impaction, and three or four minutes later the catheter is passed beyond the stone, and 10 c.c. of sterile oil injected. Should the catheter fail to pass, the force of the oil injection is increased, in the hope that the stream may dislodge the stone, or at any rate, facilitate its passage by lubrication and dilation of the lumen of the ureter below the impacted calculus. "The patient is kept well under the influence of morphine, put to bed and instructed to drink water freely to stimulate the functional activity of the kidneys, and in this way assist in expelling the stone." Hexamethylenamine should also be used very freely.

If the patient is tolerant of instrumentation, this procedure can be repeated every second or third day, increasing the size of the catheter so as to keep up an increasing dilatation of the ureter. Up to No. 14 F. may be safely employed; but if the stone is not passed by the time this size is reached, the need of surgical intervention is apparent.

The advantages of oil injection do not weigh very strongly with Braasch of the Mayo Clinic, who remarks that "It is difficult to conceive how the natural efforts of peristalsis or the natural lubrication in the ureteral mucosa could be improved on."

*Incision of the ureteral orifice* may often be all that is necessary to permit the passage into the bladder of a stone lodged near the vesical end of the ureter. Frequently the opening into the bladder will be found on the first examination to be so small that it must be enlarged before intra-ureteral procedures of any sort can be undertaken. Through the operating cystoscope the orifice can be readily incised with the ureteral scissors. As Dourmashkin has said: "This is a harmless procedure, and the little bleeding incident to it may be easily controlled with the fulguration spark." In a series of 60 cases, this author found it necessary to employ ureteral meatotomy twelve times and in no instance were there untoward results of any description.

Catheter manipulation and ureteral dilatation is the method which is commonly employed at the James Buchanan Brady Foundation, Urologic Department of the New York Hospital, and its application is illustrated in the following cases which are selected from a series of more than 50 recently seen at that clinic.

## CASE REPORTS

Case I. R. S. Jewish housewife; aged thirty-three, mother of six healthy children. Mother died of kidney trouble; childhood and family history otherwise negative.

Fifteen years ago, left nephrectomy for large hydronephrosis; health fairly good since this operation until six months ago when blood, and occasionally pus, appeared in the urine, accompanied by severe right lumbar pain.

Immediately after cystoscopy and right ureteral dilatation, the patient was able to pass a stone about the size of an orange seed. An *x*-ray exposure was then made and another cystoscopy done, both catheters being passed through the right ureter to the kidney pelvis. An irrigation of 1:2000 acriflavine was given. The patient suffered a severe chill after these manipulations and during the passage of the calculus, and complained greatly of pain during the succeeding night. Her condition, however, improved steadily until her discharge on the fifth day. As the urine showed a Bacillus proteus infection, she was instructed to return weekly for further dilatation of the ureter and irrigation of the remaining kidney pelvis.

Case II. P. D. Male, aged fifty. The present illness began four months before entrance with a sudden acute attack of pain in the left kidney region, radiating to the right testicle. During the day there were several attacks lasting about fifteen minutes. A little blood appeared in the urine, but the stream was unobstructed, and micturition did not cause pain. Two months later there was a similar attack, but more severe and lasting for eight hours, so that morphine was necessary for relief. There was considerable hematuria at this time, as well as in two further attacks which occurred about a week apart two months later. No stones were passed during any of these attacks of colic.

The physical examination on entrance showing nothing of importance save several carious teeth, and a marked phimosis, with abnormally small testicles. Neither kidney was palpable, but there was some complaint of pain on palpation in the renal region. No tenderness over the bladder.

Cystoscopic examination showed a markedly trabeculated fundus, a normal ureteral orifice on the right, but the left one somewhat edematous. No. 6 F. catheters were passed through both orifices, that on the right reaching the pelvis without difficulty. The larger instrument failing to pass on the left, No. 5 F. was substituted, and this progressed 2.5 cm. from the orifice. Phenolsulphonephthalein injection was returned on the right side only, appearing in eight minutes, and giving a total of 3 per cent, ten minutes after appearance.

X-ray with double exposure (Kretschmer test) showed stone, in contact with the catheter, about 2.5 cm. from the ureteral orifice.

Four days later another cystotomy showed the left ureteral orifice edematous and bulging, with a "mulberry stone" as large as an olive-pit extending from it. This calculus was first manipulated with a bougie, and not being dislodged in this way, the cystoscope was withdrawn, and the Lowsley operating-irrigating rongeur inserted in its place. With this instrument the stone was easily grasped and removed entire. Eleven days later, another examination showed slight sloughing at the site of lodgement of the stone, but the catheters passed readily on both sides. Both pelves were irrigated at this time, and specimens examined to determine whether there were a persistent infection of the kidneys. Five subsequent dilatations and irrigations were carried out at intervals of one or two weeks. At the second dilatation, the left catheter was obstructed after 7.5 cm. and culture of the bladder urine showed Staphylococcus albus. A week later, however, the catheter passed readily on this side and a No. 7 F. bougie was likewise inserted beside a No. 6 F. catheter. There was no further obstruction, or urinary infection.

Case III. A. Z., Male, entered with a complaint of hematuria, renal pyuria, and left-sided lumbar pain. On cystoscopy, a No. 7 F. bougie, and No. 6 F. lead catheter passed to the left kidney pelvis, and an *x*-ray was taken with catheters and cystoscope in position. B. coli communis was demonstrated in the urine. An irrigation of 1:1000 acriflavine was given to both pelves.

The *x*-ray report at this time showed the left kidney to be large but in good position, with a shadow at the upper border of the twelfth rib, apparently in the left kidney pelvis. Right kidney normal in position and size. Two weeks later a No. 6 F. catheter and a No. 7 F. bougie were passed to the renal pelvis on the left, and a No. 6 F. bougie was run in besides these for a distance of 10 cm., where its further progress was obstructed. The specimen from this ureter still showed B. coli communis. After the lapse of another fortnight, although the catheter passed to the left pelvis, the first bougie inserted, No. 7 F., was stopped at 7 cm., and a second No. 6 F. bougie was stopped at only 4 cm. Irrigation was given at each session. After another two weeks' interval, No. 6 F. catheter and bougie passed through the left ureter only to 12 cm., at which point they were obstructed. Acriflavine irrigations were kept up because of continued urinary infection. At the next session the catheter was stopped at 7 cm., but the bougie could be passed by it into the pelvis.

Another *x*-ray taken after the seventh dilatation did not show the darker shadows visible in the previous roentgenogram, but in contact with the catheter on the left side, opposite the fourth sacral foramen, was a shadow, apparently of a stone about the size of the end of one's little finger. The eighth dilatation permitted the No. 6 F. catheter to pass only 5 cm. although a bougie of the same caliber passed beside it for a distance of 10 cm. After a two weeks' interval, the catheter was stopped at 7 cm., but after some manipulation, the bougie was passed completely to the pelvis. The cystoscope was now removed and the bougie and catheter left in the ureter, being held in position by strips of adhesive plaster attached to the penis. The patient was kept in the hospital over night, in the hope that the stone could be made to pass. This was unsuccessful, and the next roentgenogram showed there was still a shadow in contact with the catheter, about 3 cm. from the bladder wall, and 5 cm. from the ureteral orifice of the left side.

Finally, four months after the dilatation were begun, No. 6 F. lead catheters passed to both pelves without any obstruction showing that the stone which had blocked the way had been passed.

This case has been given in detail to illustrate how much patience and hopefulness will sometimes be required on the part of all concerned before non-operative manipulation will bring about a successful result.

Case IV. J. D. Male. No. 6 French catheter passed for a distance of 10 cm. on the right side and 8 cm. on the left. Both ureteral orifices appeared normal. Phenolsulphonephthalein intravenously injected appeared on each side in six minutes, the total amount secreted after ten minutes being 11 per cent on the right side, and 10 per cent on the left. Roentgenogram (Kretschmer test) gave a left kidney shadow normal in size and position. The right kidney shadow was likewise normal, but in contact with the catheter on the left, opposite the fifth sacral foramen, there was a

scaphoid-shaped shadow which moved exactly with the catheter in the double exposure plate.

A second exposure was made five days later; on this occasion it was only with great difficulty that a No. 6 F. catheter of lead was passed to the pelvis on the left side. A bougie of the same caliber which was pushed in beside the catheter was arrested at 8 cm. The ureteral instruments were left in place, and the patient kept in the hospital over night in the hope that the stone would be induced to pass, as the roentgenogram and slight impairment of renal function indicated that it was of small size. This hope was not realized, however, and five days later the patient suffered a severe renal colic lasting twelve days. At the third examination, three days after the attack of colic, a careful search was made of the bladder, but no stone could be found. A catheter and bougie, each No. 6 F. and a No. 7 F. bougie were passed into the ureter but could be made to advance no further than 3 cm. This indicated that the stone had been forced downward by the attack of colic, and the prospect of its expulsion seemed good.

However, examination three weeks later showed that while a No. 6 F. bougie could be passed all the way to the left renal pelvis, a second bougie and catheter of the same caliber were arrested at 7 cm. After the lapse of another week, the second bougie and the catheter stopped at 5 cm. No further dilatations are recorded until nine weeks later, when the No. 6 F. catheter reached the pelvis, while two bougies of the same size were arrested at 5 cm., thus making a dilatation of 18 F. for the 5 cm. of ureter below the site of the stone. Two weeks thereafter, a No. 7 F.

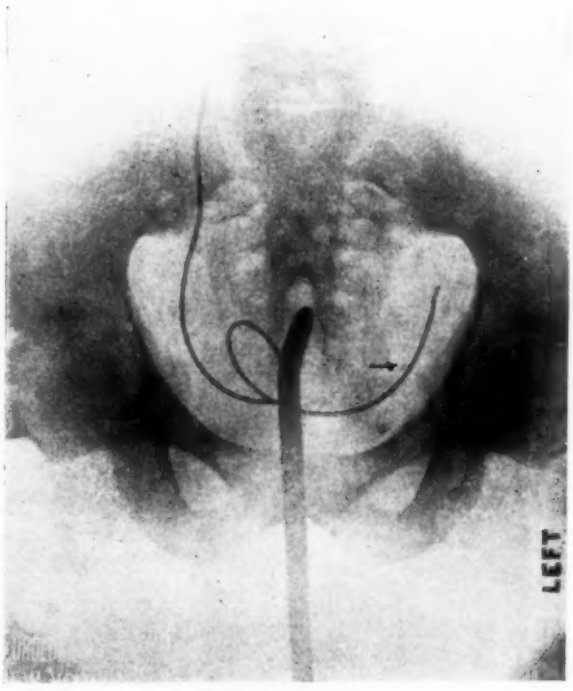


Fig. 1, Case IV

Fig. 2, Case IV

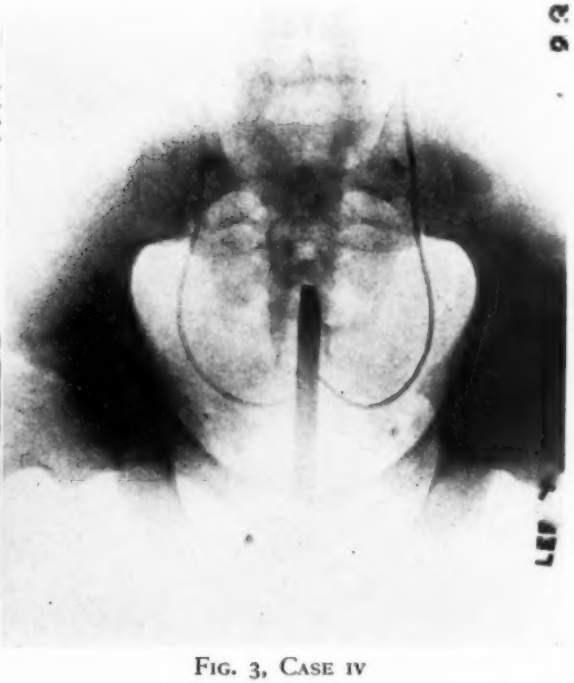

Fig. 3, Case IV

catheter passed entirely through the ureter, while two No. 6 F. bougies were arrested at about 3.5 cm. In another fortnight bougies

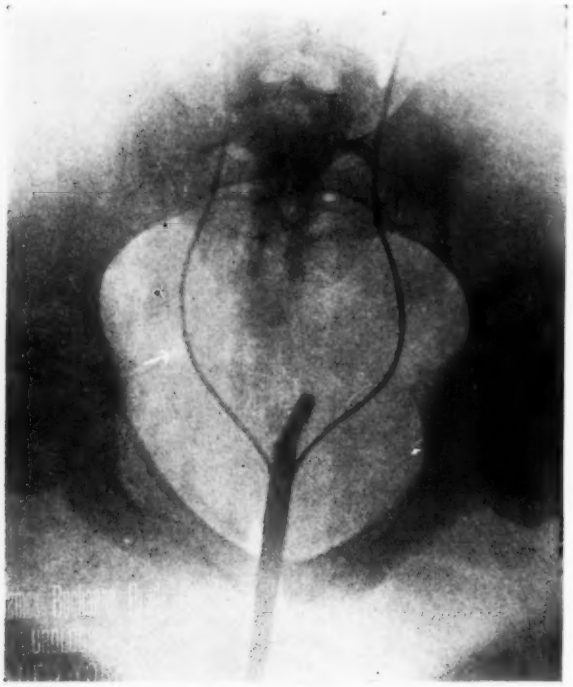

Fig. 4, Case v

the pelvis, and a roentgenogram was reported as showing no shadows such as had been evidenced on the previous plates; the patient had evidently passed the stone, as it was not shown in any portion of the ureter, or in the kidney pelvis.

In this case, twenty-three weeks of persistence were required to eliminate a small stone which appeared easily removable at the first examination.

Case v. Mrs. S. entered with a complaint of hematuria, pyuria and renal pain. On cystoscopy, the appearance of the bladder was normal and the catheters, No. 6 F., passed to each pelvis without difficulty. Phenolsulphonephthalein 4 per cent on the right side, appearing in five minutes, 17 per cent on the left side, appearing in four minutes. Pyelogram of the right side (Kretschmer test) indicated a stone in the ureter on this side. Two weeks later, three No. 6 F. bougies were passed through the right ureter to the point where the roentgenogram had indicated that a stone was located. Two weeks later, Nos. 6 and 7 F. bougies passed through the right ureter to the pelvis, but a second No. 6 catheter

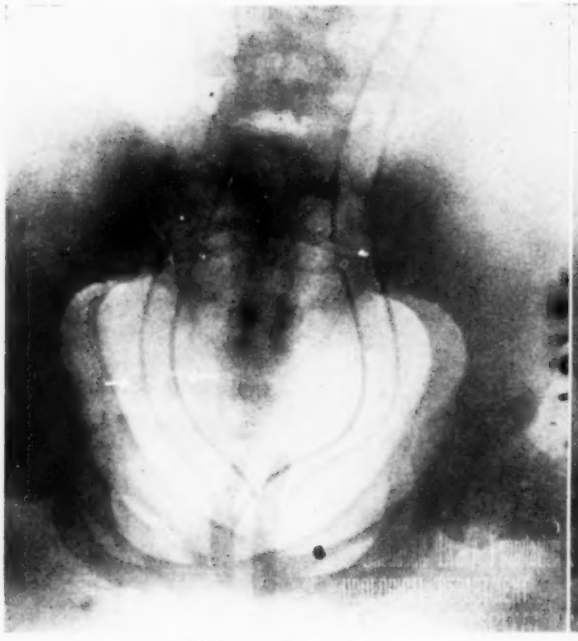

Fig. 5, Case v

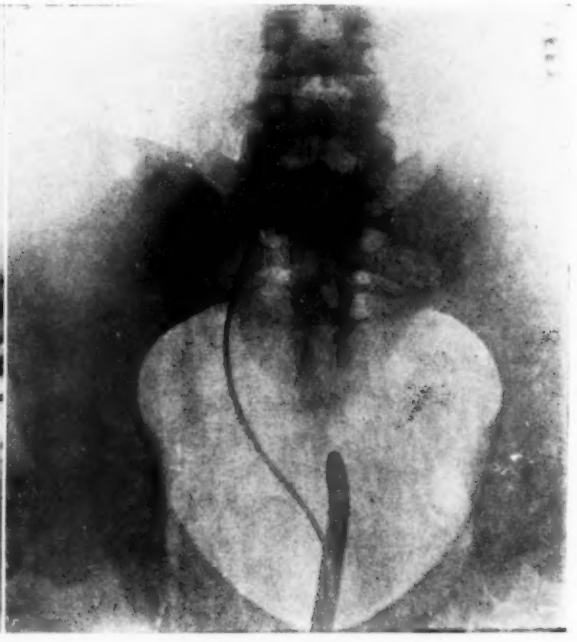

Fig. 6, Case v

No. 6 and 7 reached the pelvis, but a third instrument of the same size was stopped at 2.5 cm. After four weeks the third bougie could be advanced as far as 15 cm. and a few days thereafter, all the instruments reached

was stopped at 5 cm. The patient could not tell whether or not she had passed the stone.

X-ray with the Kretschmer double exposure showed a shadow in contact with the right catheter, which moved exactly with the

instrument. Ten days later, however, both catheters passed to the renal pelves without obstruction.

Case VI. J. H. M., male, entered with complaint of right-sided pain and hematuria. Cystoscopy showed a good sized papilloma in the middle of the trigone near the fundus. Both ureteral orifices were somewhat congested, the left more than the right. No. 6 F. catheter passed for 5 cm. on the left, but could not be passed on the right. The No. 5 with which it was replaced entered the right ureter for a distance of 10 cm. No. 5 F. finally passed the obstruction with a grating sound when inserted on the left, and progressed all the way to the pelvis. Phenolsulphonephthalein appeared on the right side in three and a half minutes, on the left in four and a half minutes; total amount secreted in ten minutes after appearance, 8 per cent on the right, 3 per cent on the left.

One week later the papilloma was cauterized and disappeared. At the same cystoscopy, No. 7 F. bougie and No. 6 F. catheter passed to the pelvis on either side. A roentgenogram taken a week later showed a shadow on the right side in contact with the shadowgraph catheter, opposite the end of the sacrum; this was constant in both pictures. A right pyelogram showed slight shagginess of the calices, and while there was no evidence of dilatation in the right pelvis, its ureter was distorted and considerably dilated, with a right-angle kink opposite the body of the fourth lumbar vertebra. Dilatation was in evidence only *above* the shadow. At this same sitting No. 6 F. catheters passed in both ureters for a distance of 10 cm. When these were replaced by No. 7 bougies, it was possible to reach both pelves.

A week later obstruction was encountered on the left, neither catheter nor bougie progressing more than 7 cm. after several trials. At two subsequent sittings at weekly intervals, it was possible to penetrate the ureter for only 5 cm. After a third week, two No. 6 F. bougies passed together to the left kidney pelvis. At the end of the fourth week the instruments were obstructed at 3 cm. and the obstruction remained at about this level for another fortnight. At this time, No. 6 F. bougies were halted after being inserted 11 cm. into the right ureter. One week after this Nos. 6 and 7 could be passed 4 cm. on the left side. Three weeks later it was found that the stone on the left side had moved from 5 cm. to 2 cm. from the orifice, and in another week all the instruments passed without obstruction to the left pelvis. A fortnight later the pelvis on either side was reached without difficulty and the roentgenogram showed no shadows. The patient, however, continued to have pain in the region of the lower left ureter.

Case VII. A. D., female, aged fifty-seven, came to the Clinic with a history of "bearing-down pains" in lower abdomen and renal region for a year past; four months before, there had been a sharp attack of pain in the right kidney region, quickly shifting to the corresponding point on the left. Since this time there had been frequent attacks of left-sided pain. Two months before hematuria had been in evidence for one week. Since the onset one year before, the patient had been obliged to rise twice, or even as many as four times during the night to urinate, with a daytime frequency of five or six times. There had been occasional burning pain on micturition. The only significant point in the previous personal history was that there had been an operation for the removal of uterine fibroid tumor at the age of twenty-seven. On physical examination extreme tenderness was evidenced in the region of the left kidney, and along the course of the left ureter. On cystoscopy, the stone was found in the left ureter, and a catheter left in place, while the patient was kept in the hospital in the hope that the stone would pass. This maneuver was successful, for the stone descended to the bladder, whence it was removed by the aid of the Lowsley rongeur, the woman being discharged cured at the end of five days.

The contrast between this case and Case IV where more than five months elapsed before the stone could be coaxed to leave the ureter emphasizes the uncertainties which attend this method of handling ureteral calculus.

In conclusion, I would emphasize the wisdom of exhausting every possible means of non-operative removal before attempting surgical intervention upon a ureter blocked by calculus. Clinical experience in many different places which covers a considerable number of years, has shown that

with care and persistence even in the face of discouragement, our efforts will practically always be rewarded by the passage of all but the very largest stones. The patient's cooperation is a very important factor in the eventual success, but this is easy enough to obtain once he comprehends that an effort is being made to obviate the suffering and hazard of an abdominal operation, to say nothing of the minor, but none the less interesting, consideration that he will avoid the expenditure of time and money incident to hospitalization for the intravesical procedures can all be carried out in the office.

Another point which is an important future consideration is the avoidance of stricture of the ureter, which is so often a sequel to the formation of scar tissue in operative wounds. All these considerations may be brought to the patient's attention, should he find continuous transvesical inspection irksome, and the repeated passage of instruments tedious and painful.

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*Continued from p. 95.

# PROGRESSIVE POSTOPERATIVE GANGRENE OF THE SKIN*

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WITHIN a year, 4 patients having progressive subcutaneous gangrene, 3 of them in advanced stages, came on our service at Harper Hospital. This number of these rare cases, as well as the poorly outlined treatment they received before the progressive gangrene was stopped, leads us to discuss the topic. In spite of the few literary contributions on the matter which bring out the importance of differential diagnosis and the kind of treatment needed, the subject is still unknown to many surgeons. While the affection has been rarely reported, verbal communications with busy colleagues show that almost every surgeon has seen one, two, or more of these dire wound complications. This fact is also stated by Meleney, who personally has seen more of such cases than any one else, and who has contributed the best articles, but perhaps has included cases not strictly belonging to this group. Meleney also states that many surgeons have seen such cases, without reporting them, or recognizing their importance.[1] Meleney himself in five years saw 14 cases, 7 of them at the Presbyterian Hospital.

## NOMENCLATURE

The following titles have been used in publishing these cases:

Progressive Enlarging Ulcers of the Abdominal Wall. Cullen.

Severe Spreading Carbunculus Infection of the Chest Wall. Christopher.

Progressive Gangrene Infection of Skin and Subcutaneous Tissues. Brewer and Meleney.

Progressive Gangrenous Ulceration of the Abdominal Wall. Shipley.

Postoperative Progressive Gangrenous Infection of Skin and Subcutaneous Tissue. Probstein and Seelig.

Progressive Gangrenous Ulceration of the Abdominal Wall. Gordon.

Gangrene of Abdominal Wall. Horsley.

Hemolytic Streptococcus Gangrene of Skin. Frank and Meleney.

Postoperative Spreading Superficial Gangrene. Alexander.

Of 14 cases of progressive gangrene of the skin, 10 of them gathered from the literature, 4 of our own, 11 were men, 3 were women. The youngest patient was four years old, 1 was eight, another eighteen, 3 between thirty and forty, and 7 past fifty years of age. The first signs of the gangrene appeared from the second to the seventh day after an operation. Six of the 14 cases of gangrene followed operation for appendicitis with drainage; 2 followed drainage of abdominal wall abscess, probably also appendiceal in origin; 2 followed drainage of a post-pneumonic empyema; 1 the amputation of a female breast for multiple abscess; 1 in the injection wound of scarlet fever serum in the buttocks; 1 in the drainage wound of an inguinal gland abscess; and 1 in a fistula of suppurative epididymitis.

*Definition.* A good description of this type of gangrene given by F. N. Gordon is as follows:

> Practically always following operation for appendiceal abscess, on the third to the tenth day, the ulceration spreads from the site of operation over the abdominal surface. The ulcer is described as carbuncular-like, spreading, serpiginous, gangrenous, etc., and as being very intractable, resisting all the ordinary measures adopted to promote healing. Spreading with great rapidity at first, this slows up as the ulcerated surface widens, and there is a tendency for the part first involved to heal. The effect of this is to have the ulceration separated from and apparently distinct from the original operative wound which may now still be draining or may be a healed scar.

* Submitted for publication October 23, 1930.

The ulceration extends from the skin downward to the deep fascia. The temperature is moderately elevated, usually from 99° to 100°, with occasionally 101°. The pulse varies from 100 to 120—leucocytes seldom go over 15,000. The appetite is usually good. The local condition is very painful and the change of dressings is accompanied by great discomfort.

Generally the gangrene is accompanied by a moderate discharge and progresses by burrowing and undermining the skin edges in the subcutaneous tissue. The process spreads about 4 mm. a day (Alexander) advancing in serpiginous lines. Very intense pain was mentioned in 9 of the 14 cases. In 1 case reported by Christopher, the pain was so severe that practically all dressings had to be done under gas anesthesia. The fever usually is slight and rarely rises above 102° F. As a rule, 100° is the limit. The greatest extent of the final gangrene probably is in the 2 cases following empyema, where the gangrene extended from the scapula down beyond the buttocks, forward to the navel and backward to the midline. In the cases following appendicitis, the skin of one-half of the abdomen often sloughed away, and in 1 case it extended even beyond the buttocks to the loin. In our scrotal case, practically all the skin on the left side of the scrotum was lost.

*Duration Up to Healing:* The time from onset to healing was from two months to twenty-two months. In the 14 cases gathered by us, not one patient died.

## DIFFERENTIAL DIAGNOSIS

This superficial gangrene should be distinguished first from common wound infection, erysipelas, and then the more severe sloughing gangrenes of the abdominal wall which follow gas bacillus infection from the intestines. Simple wound retention and erysipelas on the first day will perhaps look somewhat like the gangrene under consideration, but will not have the rather insidious onset and the erysipelas and retention in wound will not lead to progressive gangrene.

Postoperative gas bacillus infection of the abdominal wall[2] comes with much more severe symptoms than does superficial gangrene. The patient is prostrated. The skin around the wound is brownish, edematous, and there is a foul-smelling discharge, also crepitation from gas around the wound and positive bacterial findings of gas bacilli (Welchii). Obviously, the prognosis for this type of gangrene is much more serious than for the progressive cutaneous gangrene. The chapter on this more severe gas infection of the abdominal wall has been covered by Butler, Jennings, Winter, Russell, Bier, and others.

Horsley[3] reports a case where practically the whole side of the abdominal wall sloughed following an intestinal resection for intussusception with intestinal polyp. The process started right away with massive death of the tissues, in which the skin and subcutaneous tissues were less affected than the muscles were. While the culture did not show gas bacillus, it showed chains of streptococcus, gram positive diplococci, colon bacilli, the latter suggesting that we were not dealing with cutaneous gangrene but with sloughs produced by colon bacilli of intestinal origin.

The gangrene which we are discussing does not extend deeper than the skin. It is also doubtful whether the cases mentioned by Meleney in his first publications, in which he gives his experience in China, on gangrene of the skin of the legs following scratch wounds (over 20 cases reported), should really come under this group, as the conditions he mentions had to be taken care of by deep incisions, pointing out that the infection traveled more in the deep tissues than in the skin proper.

On the scrotum, a moist gangrenous process, which is also very fatal, produced a sloughing of the scrotum within a day or two. Many of these patients die within three or four days. The origin of this process is considered a breaking down of deep diverticula of the sigmoid, followed by infection of the lateral wall of the bladder,

and then following the arrangement of the fascial planes, the infection penetrates near the urethra into the perineum and scrotum. During the past two or three years we have had 2 such cases at Harper Hospital. These were in middle-aged men brought to the hospital with acute black slough of the scrotum and some gas formation in the tissues, in a condition of severe sepsis, and giving the picture of a perforated urethra. Neither of these patients had any trauma or history of any stricture that could have accounted for the severe septic infiltration of the tissues. Both patients died. I have no doubt that the article mentioned makes clear that these acute gangrenous processes of the scrotum are due to anaerobic bacteria from a perforating diverticulum of the bowel.

This is an entirely different process from the rather dry gangrene in our case of gangrene of the scrotum, which was entirely limited to the skin and lasted several months before it was stopped. The two types of gangrene of the scrotum have the same relationship to each other as gas bacillus of the abdominal wall has to the cutaneous gangrene under consideration. Such a case as ours of cutaneous gangrene in the groin following drainage of an inguinal lymph gland abscess might suggest the presence of granuloma inguinale, but this was easily excluded by the failure to find Leishman-Donovan bodies.

The progressive postoperative gangrene is usually a gangrenous process following the drainage of a wound within three to ten days, sometimes later, but is characterized by slow, burrowing, subcutaneous advance of the gangrene, destroying the skin, but not going into the deep tissues.

## ETIOLOGY

All authors writing on this ulceration have endeavored to find a specific germ causing it. Cullen found Streptococcus brevis. Christoper in his case following empyema found gram positive cocci plus hemolytic streptococci. Brewer and Meleney mention first their finding of a large variety of organisms, without any definite conclusions as to the pathogenicity. In a second case they found hemolytic staphylococcus with diphtheroid bacilli in aerobic culture and streptococcus in anaerobic, etc. Nearly all the authors found several varieties of organisms in aerobic and anaerobic cultures in these gangrenes.

Meleney and Brewer report an extensive study on the etiology and found that with hemolytic staphylococcus aureus and diphtheroid bacilli from one of their cases, they could produce in animals, by the injection of cultures of these two bacilli, gangrene around the place of the injection when both bacilli were injected together; but no ulceration would follow if one of the organisms was injected alone. The conclusion of Brewer and Meleney after experimental studies was: "The infection with streptococcus prepared the way for the gangrenous process, but for its actual production a second organism was necessary, in this case the Staphylococcus aureus."

Shipley reached the same conclusions, namely that the combination of the two organisms causes an increased virulence of both, and leads to sloughing gangrene, and he believes that such symbiotic action of the two organisms is the cause of the gangrene.

From an etiological point of view, the case of Meleney of hemolytic streptococcus gangrene following the administration of scarlet fever antitoxin is very interesting. An eight-year old girl, seven weeks before her admission to the Presbyterian Hospital in New York, was given a prophylactic dose of scarlet fever serum, in the right buttock, because an older sister had come down with the disease. Four days later she developed typical scarlet, with fever, sore throat, and rash. She was then given a large dose of scarlet fever serum in the left buttock. On the second day the swelling caused by this injection increased, and on the fourth day the skin became dusky and bullae and blisters formed, and frank

gangrene followed over the whole left buttock, thigh and across the abdomen. A complete cure was established from the

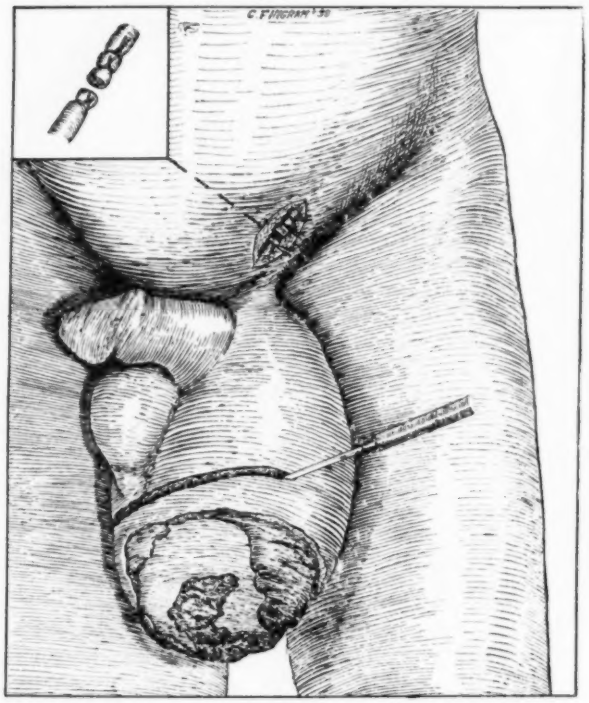

Fig. 1. Gangrene of scrotum (accompanying cystic liver). Date of operation, Jan. 23, 1930.

gangrenous process by incision and skin grafting.

The etiological consideration of Meleney reads as follows:

> The exceedingly rapid development of necrosis in this type of streptococcus infection resembles strikingly the necrosis which takes place in experimental animals which have been made hypersensitive or allergic. Hypersensitivity to bacterial products resulting in necrosis of tissue has at least two different manifestations. First that which Zinsser and Grinnell, Mackenzie and Woo, Julianelle and Avery and others have described which consists of a phase of hypersensitivity in the course of repeated weekly intradermal inoculations of bacterial extracts or autolysates coming on about three to four weeks after the first injection, lasting a week or ten days and then passing off. The second hypersensitive manifestation is that which has recently been observed and studied by Shwartzman. He has found that when filtrates of certain organisms are injected into the skin of animals, there is little or no primary reaction, but twenty-four hours later, if the same filtrate be injected into the vein of the animal, the areas of previous intradermal injection within a few hours become swollen and red and then certain portions turn blue, blisters form and frank gangrene of the tissues develops. This phase of hypersensitivity only lasts for about twenty-four to forty-eight hours after the primary inoculation, but the reaction is more severe than in the other type.[1]

Meleney's patient was in a hypersensitive stage on account of previous prophylactic antitoxin injection, and the second injection in the other buttock, during this sensitization, led to gangrene.

With the observations of Arthus and others, it is well established that frequent cutaneous necrosis occurs in rabbits and guinea pigs that have been used repeatedly for injections of bacterial and protein products.

## CASE REPORTS

Case I. T. S., aged eighteen, male, colored, single, entered Harper Hospital for the first time January 4, 1930, complaining of swelling of the left side of scrotum for one and a half years. The history is that of gradually increasing swelling of the left side of scrotum, associated with vague pain. For the past two months there had been a gradually spreading ulceration, starting as a boil. There had been a painless mass in the upper abdomen since infancy.

Physical examination showed a large swelling of the left testicle with a sloughing area in lower part of scrotum 4 × 4 cm., covered with grayish necrotic base (Fig. 1). There was a smooth, now tender, mass in the upper abdomen extending to within 2 in. of the umbilicus. Blood Wassermann reaction four plus.

*Operation*, January 23, 1930: With cautery knife the ulcerated area was excised with wide border, after we first divided the spermatic cord in inguinal region. Testicle and cord. Drained through upper wound.

Patient left hospital on February 3, with only slight discharge from wound.

Patient received potassium iodide last ten days in hospital.

Case II. Mr. H. P., aged fifty-four, male,

white, entered Harper Hospital May 2, 1927, with lobar pneumonia and pleural effusion, left.

Fig. 1a.

*May* 5, was tapped and 20 c.c. straw fluid removed.

*May* 13, rib resection, left eighth rib, posterior, 8 oz. pus obtained, streptococcus by culture.

Fig. 2. Fig. 3.

Figs. 2 and 3. Gangrene of skin following drainage of empyema.

*June* 6, 1927. Carbuncle or sloughing area just above wound in chest, about 3 in. in diameter.

*July* 29, 1927. Edges of slough excised. Had spread all around incision to an area 6 × 10 in.

*August* 11, 1927. Necrotic edges of whole border of very large carbuncle on left side of thorax excised.

The sloughing area continued to spread in spite of the repeated excision of edges, until sometime in January, 1928, when healing began, which was practically complete by April 7, 1928 (Figs. 2 and 3).

Patient last seen on January 3, 1930. Still had discharging sinus in thorax.

Case iii. J. F., aged four, male, white.

This patient was first seen on May 14, 1927, when he had an abscess in the left inguinal region of one week's duration. The abscess was incised and drained with a rubber tube. On draining, sinus continued to discharge pus, and there was a sloughing area around the wound. The patient was seen by several other physicians at the Ford Hospital and at Grace Hospital, but the ulcerated area in the left groin continued to drain in spite of all treatment.

Patient again came under our care on August 24, 1928 and from that time until March 17, 1929, he was in Harper Hospital under treatment, light treatment, *x*-ray curetting, cauterization, skin grafting, and high caloric diet

Fig. 4. Gangrene of skin following drainage of suppurative lymphadenitis.

being used, and he was finally discharged from the hospital, healed, save for a small area which subsequently closed in well. (Photograph was taken in December, 1929, Fig. 4.)

Various diagnoses were made during the course of treatment such as tuberculous granuloma inguinalae and phagedenic ulcer,

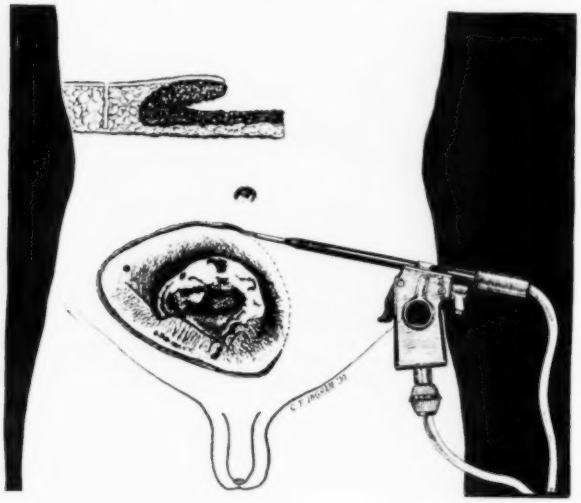

Fig. 5.

but at no time was the diagnosis of tuberculosis confirmed and guinea pig inoculations were negative.

Case iv. Mr. H. S., aged fifty-two, male, white. Insurance dealer.

Entered Harper Hospital, December 24, 1929 for the first time with the story that four weeks before he had been operated upon for gangrenous appendicitis. The wound was drained with one cigarette wick, which was removed after two weeks. About this time a gradually spreading ulceration of the abdominal wall developed.

*Past and family history*, irrelevant.

*Physical examination* negative save for a semicircular sloughing area with granulating base above the oblique incision in right lower quadrant (Fig. 5).

*Operation* December 25, 1929. The gangrenous area and 2 cm. border of healthy tissue excised with electrocautery knife down to deep fascia.

*Postoperative course:* Wet bichloride dressings twenty-four hours, then vaseline dressings.

December 30, Thiersch grafts applied.

January 8, 1930, Thiersch grafts applied.

Most grafts "took" well and wound was all healed by February 10th, 1930.

From one of our cases (H. S.) the culture grown in brain broth produced two organisms, a short streptococcus growing occasionally as a diplococcus, and a diphtheroid bacillus. These were difficult to separate and we never succeeded in getting them

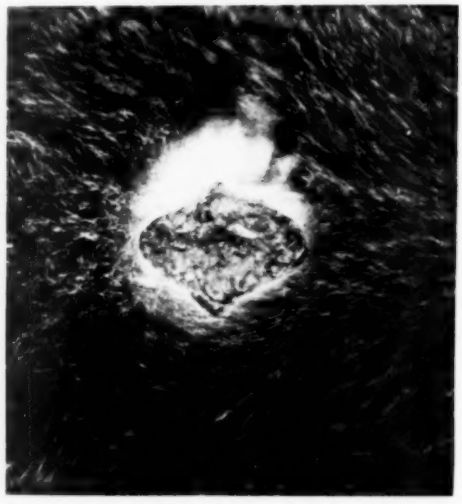

Fig. 6. Gangrene produced by reinfection of mixed culture twenty-one days after original inoculation.

separated in pure culture; however, unless grown as anaerobes the streptococcus had a tendency to overgrow and mask the diphtheroid.

The following protocols of three rabbits illustrate the different types of reaction to injections of these organisms.

Rabbit 1. May 6, 1930. Two hundred cubic centimeters mixed broth culture subcutaneously. No apparent change at site of inoculation four days later.

May 10, 1930. Five cubic centimeters mixed culture inoculated at the same site. Two days later a small nodule was felt at the site of inoculation.

May 13, 1930. Ten cubic centimeters mixed culture at same site. The nodule noted here persisted for four days when (May 17, 1930) 12 c.c. of mixed culture were administered at the original site. There was marked inflammatory reaction and the skin was thickened and tough.

May 18, 1930. Rabbit died of sepsis.

This series of very large doses repeated every four days produced no gangrene, but the animal finally succumbed to general infection.

Rabbit 2. May 6, 1930. Two cubic centimeters of mixed culture subcutaneously. During the next two days there was no apparent change.

May 8, 1930. Seven cubic centimeters of mixed culture subcutaneously at *a new site* of inoculation.

May 9, 1930. No apparent change in either area.

May 10, 1930. Swelling and redness at second site of inoculation. Five cubic centimeters of mixed culture subcutaneously, at a new site.

May 12, 1930. Swelling and redness at the second and third sites, more marked at the second site.

May 13, 1930. Condition of the second and third sites is improved; ten cubic centimeters of mixed culture are given in a new site subcutaneously.

May 14, 1930. No marked reaction at any of the sites of inoculation.

May 22, 1930. The abscesses have been formed which did not break down and gradually organized.

May 27, 1930. Fifteen cubic centimeters mixed culture in new site. The swellings and thickenings from previous injections still present, but no gangrene developed at any time.

Rabbit 3. May 6, 1930. Two cubic centimeters mixed culture subcutaneously. No apparent local reaction.

Twenty-one days later, May 27, 1930, 15 c.c. mixed culture injected at original site. Two days later an open ulcer with the typical undermining gangrene appeared (Fig. 6).

The cases of gangrene of this type so far reported clinically as well as the case of tissue hypersensitiveness reported by Gatewood and Baldridge[4] and the rabbit experiments here outlined, make it appear likely that the gangrene is an example of the so-called Arthus phenomenon.

Arthus[5] noted that animals receiving repeated injections of horse serum were affected by these areas of cutaneous gangrene. This work was followed by publications by Lewis, Otto, Hooker, Park, and Stewart,[4] whose experiments showed that under proper conditions repeated injections of foreign protein were likely to lead to severe local tissue destruction.

The rabbit protocols selected for illustration of our experimental work seem to support this idea. The organisms in themselves were of very low grade virulence and only produced results in huge doses. Large injections *frequently* repeated were well resisted, but reinjection after a sensitization interval produced characteristic gangrene.

## TREATMENT

The treatment of this spreading gangrene of the skin, mostly following draining wounds, should be based first on early recognition of the process. The diagnosis and treatment should be especially referred to the process undermining the skin.

Second, all treatment with antiseptic solutions, Dakin's solution, etc., is not dependable. Treatment with *x*-ray and different light treatments have not given uniformly good results. In some instances it is mentioned that the process "burns itself out"; but this happens only after weeks and months of suffering, and it is to be remembered that lately at least 2 fatal cases have been reported, and it is most likely that generally the fatal results do not get into print. The reports of Shipley and Alexander, and our own cases are proof that the rational method consists in cutting around the undermined edges, best with an electrocautery knife, excising in this way the whole serpiginous edge of the process, about 1 to 2 cm. from the undermined area (Fig. 5). It is not necessary to cauterize the middle of the defect where the process has stopped, but the progressive gangrene of the skin should be excised. The pain usually stops immediately after this, and the wound can be covered with vaseline or any moist dressing, and the defect can be skin-grafted after a week. This process shortens the time of healing to as many weeks as it formerly consumed months and perhaps years.

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# FACTORS IN THE TREATMENT OF POSTOPERATIVE AND INOPERABLE TUBERCULOSIS OF THE GENITOURINARY TRACT*

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IN the treatment of postoperative and inoperable tuberculosis of the genitourinary tract there are considerations which apply in a general manner to this class of patients. These are only applicable within wide limits and are subject to exceptions in individual patients. The wide variability of the manifestations of tuberculosis in the genitourinary tract necessarily imposes limitations on general statements. Yet it is upon factors of this character that satisfactory results from treatment often depend.

Primarily it is important that patients unless they are hopelessly ill, be advised of the nature of their disease. They should be informed that they have tuberculosis which has invaded the genitourinary tract. It is generally a shock to learn the cause of the illness but composure is soon regained and they are then more earnest and conscientious in carrying on their treatment. For only through comprehending the cause and the nature of the disease will the need be seen for the long painstaking course of necessary treatment. It is unfortunate when only a suggestion of the real condition is given for it often leaves a feeling of carelessness to treatment. The good results which so frequently follow the surgical treatment of genitourinary tuberculosis encourage giving patients full information regarding the nature of the illness.

It is an equally important factor that the plan of treatment be outlined and described when treatment is begun. At the present time it is generally accepted that the treatment should consist of surgery, when it is feasible, and after the surgical care a long course of hygienic and anti-tuberculosis care adapted to the patient's needs. A clear understanding that both surgical and postsurgical treatment, which may have to be continued for a long time, is important in the plan of care and will frequently prevent later misunderstandings.

Patients occasionally are seen who have become discouraged with their progress elsewhere, through misunderstandings of this sort. They had assumed that when they were operated upon their trouble would be cured and the symptoms would immediately disappear. But this had not occurred and after the operation the frequency of urination, burning and other bladder symptoms still persisted. Or another tuberculosis lesion had developed in another site in the genitourinary tract. As a result they had lost confidence and become distrustful of obtaining relief. Many of them did not understand their present state and they had discontinued their former treatment. An outline of the plan of treatment, before the surgical care, describing the necessity of the postsurgical treatment might have prevented the misunderstanding. It not only serves no useful purpose but it often tends to jeopardize the outcome when patients are not aware of what treatment entails.

It has been found to be a practical plan to explain that the treatment of their illness is divided in two parts, the surgical and postsurgical. The object of the surgery is to remove the active focus of the disease insofar as it may be accomplished. The after care is to heal whatever postoperative sinuses remain, to palliate and to attempt to relieve the symptoms; then to fit to the patient a regimen that will have for its object the building up of the general health thus attempting to arrest any lesions which remain and to help prevent further development of the disease. The inoperable patients are treated by a similar

* From the Department of Urology (James Buchanan Brady Foundation) New York Hospital, New York, Read before the Genito-Urinary Section of the New York Academy of Medicine, May 21, 1930.

regimen of medical care. It is important to emphasize that the routine must extend over a long period of time and that there are remissions and exacerbations of the symptoms.

The question of where and how best to carry on the postoperative and inoperable treatment comes up for decision at the outset with each patient. There are numerous points to consider. If the disease is very extensive and the outlook discouraging it is probably best for the patient to remain at home. For others with more hopeful prognoses the question arises of whether to go to a health resort, to farms or boarding houses in the country, to a tuberculosis sanatorium or to remain at home.

To go away to one of the health resorts for tuberculosis is usually a question of finances. Considerable money is required to stay at such resorts and to receive competent medical attention for the length of time that is usually necessary to benefit the patient. The number who have sufficient means is apparently not large. To encourage the others in this course often means adding financial worries to their physical troubles.

To go to the farms and boarding houses in the country, remote from specialized medical care, is frequently of doubtful value. The tendency is to drift away from the program of urological and anti-tuberculosis care, when alone and away from medical oversight and contact.

Tuberculosis sanatorium treatment has been rather unsatisfactory in our experience when there are no active lung lesions and the disease is localized in the genitourinary tract. The public sanatoria are mostly all conducted for patients ill with tuberculosis of the lungs and there are no seperate provisions for those with urologic tuberculosis. As a result they are placed with pulmonary tuberculosis patients which many resent and refuse to accept. Sanatorium treatment in an institution especially constructed, equipped and manned for urologic tuberculosis would seem to be an ideal method but unfortunately there are no institutions of that type.

Concerning home treatment it is obvious that treatment is usually begun at home regardless of whether patients go away to health resorts, to the country or sanatoria. And since many do not stay at these places until entirely cured it must be resumed after their return.

Probably the chief reason that treatment must be carried on mainly at home is that it is least expensive. The expenses incurred before and during the diagnosis of the disease, also the costs of hospital care and of the surgical procedures in the operable patients have often depleted their resources. Moreover since the illness is of a chronic nature and treatment must be long continued there is a natural desire to be economical.

Most people have little inclination to go away from home when ill if it can be avoided. They are reluctant about entering tuberculosis sanatoria for treatment. They dislike to break up home ties and to remove for long periods to new surroundings away from their occupation or business. Many, particularly the postoperative patients, can return at least part-time to their work after treatment has been carried on for a time. Removal to a different climate seems to be losing much of its former attraction since it is becoming known that there is no climate which is helpful for all tuberculosis patients. The disease is being successfully treated in practically all climates.

A disadvantage of home care is the lack of control of the patient's routine from the standpoint of rest, fresh air and diet as contrasted with sanatorium treatment. Also the distractions of the home are a drawback, particularly the activities of the other healthy members of the family.

Home care allied with that of a clinic established solely for the study and treatment of postoperative and inoperable urologic tuberculosis, seems to work out fairly well in our experience. Practically all of our patients are ambulant, since active pulmonary cases are transferred to sanatoria, and can make regular visits to the clinic. Four clinic sessions are held weekly and are so arranged that it is

TABLE I

POSTOPERATIVE UROLOGIC TUBERCULOSIS

| Case No. | Sex | Age | Operation | Duration of Treatment | Pulmonary Lesions | Results of Treatment | Able to Work |
|---|---|---|---|---|---|---|---|
| | | | | (Months) | | | |
| 288987 | F. | 23 | Nephrectomy | 6 | Arrested | Improved | Yes |
| 281063 | F. | 54 | Nephrectomy | 24 | None | Improved | Yes |
| 269521 | F. | 22 | Nephrectomy | 22 | None | Improved | Part-time |
| 266527 | M. | 42 | Nephrectomy | 7 | None | Improved | Yes |
| 241757 | F. | 50 | Nephrectomy | 3 | Arrested | Stationary | Yes |
| 280285 | F. | 24 | Nephrectomy | 27 | None | Improved | Yes |
| 275988 | F. | 58 | Nephrectomy | 8 | None | Improved | Yes |
| 273288 | M. | 24 | Nephrectomy | 16 | Arrested | Improved | Yes |
| 150984 | M. | 48 | Nephrectomy | 33 | None | Stationary | Yes |
| 283065 | F. | 21 | Nephrectomy | 4 | Arrested | Improved | Yes |
| 265073 | F. | 18 | Nephrectomy | 6 | Arrested | Retrograding | No |
| 132472 | M. | 23 | Nephrectomy | 16 | None | Improved | Yes |
| 274641 | M. | 34 | Nephrectomy | 32 | Arrested | Improved | Yes |
| 278193 | M. | 50 | Nephrectomy | 7 | None | Improved | Yes |
| 138435 | F. | 46 | Nephrectomy | 30 | None | Improved | Yes |
| 122768 | F. | 42 | Nephrectomy | 33 | Arrested | Stationary | No |
| 260143 | F. | 37 | Nephrectomy | 28 | None | Improved | Yes |
| 289607 | M. | 33 | Nephrectomy | 5 | None | Improved | Part-time |
| 288081 | F. | 39 | Nephrectomy | 8 | None | Improved | Part-time |
| 274018 | F. | 50 | Nephrectomy | 3 | None | Improved | No |
| 257480 | F. | 46 | Nephrectomy | 19 | None | Improved | Yes |
| 250689 | M. | 27 | Nephrectomy | 15 | None | Improved | Yes |
| 289043 | F. | 17 | Nephrectomy | 7 | None | Improved | Yes |
| 269406 | F. | 33 | Nephrectomy | 31 | None | Improved | Yes |
| 271706 | M. | 40 | Nephrectomy | 22 | None | Retrograding | No |
| 116865 | F. | 45 | Nephrectomy | 36 | None | Improved | Yes |
| 279013 | M. | 48 | Nephrectomy | 24 | None | Improved | Yes |
| 274163 | M. | 28 | Nephrectomy | 4 | None | Improved | Yes |
| 269083 | M. | 34 | Nephrectomy | 12 | None | Improved | Yes |
| 150983 | F. | 43 | Nephrectomy | 24 | None | Improved | Yes |
| 290485 | M. | 35 | Nephrectomy | 5 | None | Stationary | Part-time |
| 282046 | F. | 27 | Nephrectomy | 22 | None | Improved | Yes |
| 268306 | M. | 41 | Nephrectomy and (Epididymectomy) | 7 | Arrested | Retrograding | No |
| 257277 | M. | 36 | Nephrectomy | 18 | None | Retrograding | No |
| 288047 | M. | 33 | Epididymectomy | 9 | None | Improved | Yes |
| 250985 | M. | 13 | Epididymectomy | 5 | Arrested | Improved | Yes |
| 277248 | M. | 61 | Epididymectomy | 5 | None | Improved | Yes |
| 280406 | M. | 21 | Epididymectomy | 18 | None | Improved | Yes |
| 279404 | M. | 26 | Epididymectomy | 5 | None | Improved | Yes |
| 291789 | M. | 50 | Epididymectomy | 3 | Arrested | Improved | Yes |
| 267216 | M. | 28 | Epididymectomy and (Seminal Vesiculectomy) | 10 | Arrested | Died | |

| | | | |
|---|---|---|---|
| Total number treated | 41 | Arrested pulmonary lesions | 11 |
| Died | 1 | No pulmonary lesion found | 30 |
| Retrograding | 4 | Able to work | 30 |
| Stationary | 4 | Able to work part-time | 4 |
| Improved | 32 | Unable to work | 7 |

convenient for patients to attend who are working. This grouping or class method of care brings together people with similar ailments which tends to engender better morale and confidence. It makes possible the development of special procedures and it affords an opportunity to study the value of therapeutic measures. Also there is a very real advantage in carrying on the treatment in the urological department of a hospital where there are ample facilities and equipment for urological care.

Tables I and II show the kinds of patients treated in our clinic and the results. Only

Table II

INOPERABLE UROLOGIC TUBERCULOSIS

| Case No. | Sex | Age | Lesion | Duration of Treatment | Pulmonary Lesions | Results of Treatment | Able to Work |
|---|---|---|---|---|---|---|---|
| | | | | (Months) | | | |
| 288973 | M. | 39 | Bilateral renal | 19 | None | Retrograding | No |
| 166571 | F. | 41 | Bilateral renal | 9 | None | Improved | Part-time |
| 278631 | F. | 57 | Bilateral renal | 13 | Arrested | Improved | Part-time |
| 289604 | M. | 50 | Bilateral renal | 5 | None | Retrograding | No |
| 286032 | F. | 26 | Bilateral renal | 22 | Arrested | Improved | No |
| 160841 | M. | 22 | Bilateral renal | 8 | Arrested | Stationary | Yes |
| 173691 | F. | 27 | Bilateral renal | 5 | None | Stationary | No |
| 169078 | F. | 22 | Bilateral renal | 9 | None | Stationary | No |
| 280486 | M. | 17 | Bilateral renal | 22 | None | Stationary | No |
| 133143 | M. | 32 | Bilateral renal | 24 | None | Stationary | Part-time |
| 180496 | M. | 34 | Bilateral renal | 9 | Arrested | Improved | Yes |
| 165071 | M. | 30 | Bilateral renal | 7 | None | Stationary | Yes |
| 174263 | M. | 17 | Bilateral renal | 16 | None | Stationary | Yes |
| 182467 | M. | 26 | Bilateral renal | 8 | None | Retrograding | No |
| 164125 | M. | 35 | Bilateral renal (also Tuberculous vesicles) | 5 | None | Retrograding | No |
| 130154 | F. | 28 | Bilateral renal | 48 | None | Retrograding | No |
| 272576 | M. | 20 | Bilateral renal (also Tuberculous Spine) | 18 | Arrested | Stationary | Part-time |
| 157904 | M. | 38 | Bilateral renal | 24 | None | Improved | Yes |
| 286982 | M. | 18 | Bilateral renal | 14 | None | Improved | Yes |
| 186642 | M. | 17 | Bilateral renal | 4 | None | Stationary | Yes |
| 144698 | M. | 24 | Bilateral renal | 4 | None | Improved | Yes |
| 151037 | F. | 52 | Unilateral renal (Refused operation) | 30 | None | Improved | Yes |
| 154841 | M. | 27 | Tuberculous prostate and vesicles | 21 | None | Stationary | Part-time |
| 175068 | M. | 22 | Tuberculous prostate and Epididymes | 4 | Arrested | Improved | Yes |
| 138439 | M. | 37 | T. B. Vesicles and Testicle | 13 | None | Improved | Yes |
| 133934 | M. | 32 | T. B. Testicles | 36 | Arrested | Retrograding | No |
| 133107 | M. | 40 | T. B. Testicles | 6 | Arrested | Retrograding | No |
| 166077 | M. | 43 | T. B. Testicles | 12 | None | Improved | Yes |
| 133083 | M. | 27 | T. B. Testicles | 4 | Arrested | Improved | Yes |
| 159687 | M. | 48 | T. B. Testicles (also Epididymes) | 7 | None | Stationary | Yes |

| | | | |
|---|---|---|---|
| Total number treated | 30 | No pulmonary lesion found | 21 |
| Retrograding | 7 | Able to work | 14 |
| Stationary | 11 | Able to work part-time | 5 |
| Improved | 12 | Unable to work | 11 |
| Arrested pulmonary lesions | 9 | | |

those under treatment three months or longer were tabulated. The total of both groups is 71. Of these one died, 11 seem to be retrograding, 15 seem stationary and 47 seem to be improved. The best results occurred in the postoperative patients who constitute the largest number. There are 20 with evidence in the lungs which seemed indicative of arrested or inactive pulmonary lesions. Some gave histories of previous illness with active lung trouble. In the others the signs seemed sufficient to warrant the presumption of arrested or inactive lesions. There are 26 females and 45 males. The ages vary from thirteen to sixty-one years and the average age is thirty-four. The duration of treatment varys from three to forty-eight months and the average is fourteen months. Forty-four are able to work at their usual occupations, 9 work part-time and 18 are unable to work. Many of those able to work are undoubtedly hampered more or less by their symptoms.

In regards to treatment it is essential to bear in mind that the disease has not only a local but a general bodily effect as well. To determine what the regimen of care should be it is necessary to consider the data elicited in arriving at the diagnosis, the surgical, pathological or other laboratory findings and the present local and general symptoms. With the knowledge thus gained of the patient a program may be built up to fit the individual needs.

It is difficult to describe concisely treatment of this kind but it seems in our work to fall logically along two lines, the urological and the tuberculosis. The urological care varies widely with the many different aspects of the disease in the genitourinary tract. Briefly, it includes local urethral, bladder, ureteral and renal treatments, when these are indicated, additional operative surgical procedures as the need may arise and occasionally adjuvant operations such as light fulgurations of sluggish bladder ulcers. The tuberculosis care consists of the traditional treatment of the disease, rest, fresh air and proper diet, to which are added quartz light, tuberculin and medicinal therapy.

One should not overlook that it is the combination of these various elements which yields the best results. A part or parts of this basic program should not be selected and treatment limited to it. For example, it is a mistake to assume that urinary tuberculosis can always be successfully treated by vigorous local bladder treatment along with instructions to eat plenty of eggs and milk. No single element of the treatment has yet received sufficient indorsement to warrant its exclusive use.

There is another factor relating to this class of patients as a whole which is rather difficult to define. A considerable measure of the success of the treatment depends upon the physician who carries it on. His attitude to the monotony of the long course of treatment and his ability to gain the confidence and to inspire the patient to continue when conditions are at times going adversely will have much influence on the final outcome. The regimen is largely a method of living and it is his function to impart the rudiments of what the patient must learn. If he has a warm sympathy for urologic tuberculosis patients especially those with distressing symptoms which seem unyielding to treatment and if he can be patient with them in their hopes and in their times of discouragement and in the periods of latency and activity of their symptoms, he will render them real service.

It has been said that no physician could possibly be the possessor of all the qualities that are necessary adequately to treat tuberculosis. It is probably all the more true of urologic tuberculosis which involves both the field of urology and that of tuberculosis. The care of patients of this kind is administered best when there is cooperation between the urologist and the physician who treats tuberculosis.

Dr. L. T. Lewald: I should just like to say a word in regard to the association of pulmonary tuberculosis with tuberculosis of the urinary tract. I would call attention to the mistake of over-reading *x*-ray films of the chest, and reading into them an active tuberculosis when there is nothing more there than the old healed childhood tuberculosis with a few shadows of calcified glands. I have just been going over several thousand films of Board of Health cases for admission to Tuberculosis Sanitoria and I was amazed to find there was an over-diagnosis of supposed active tuberculosis in cases which have been proved to be *healed childhood lesions*. I think we must be very cautious in making a diagnosis of a case which we suspect is tuberculosis of the kidney as confirmed by an over-enthusiastic diagnosis of chest tuberculosis, when based on shadows which all of us have in our own chests. In other words, the diagnosis of tuberculosis of the urinary tract should be based upon the local findings, and *x*-ray and laboratory evidence *as related to the urinary tract itself.*

# BRONCHIECTASIS: DIAGNOSIS AND TREATMENT*

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BRONCHIECTASIS is a condition or disease often mistaken for chronic bronchitis, and such a diagnosis is made by the general practitioner and treated with many types of medication from pills to ointments for years without any relief. Each so-called case of chronic bronchitis has a definite etiology and in order to obtain relief one must search for the important underlying cause. When a bronchitic cough lasts more than three months, it should not be treated with medication but bacteriological and *x*-ray examination should be resorted to, including an examination of the nasopharynx and nasal accessory sinuses, because close inquiry will show many of these patients virtually blowing their noses into the pharynx which produces a descending infection of the larynx and trachea. Shortly afterward the patient develops a cough with expectoration.

Many cases of bronchiectasis are also wrongly diagnosed as acute pulmonary tuberculosis.

Bronchiectasis is an infection in a pathological dilatation in the bronchial segment and occurs partly as the result of an increased pressure on the bronchial wall and partly as the result of a change in the texture of the bronchial wall, including the surrounding lung tissue. The disease causes degeneration of the muscular fibers, which is followed by loss of elasticity and tonicity whence the dilatation occurs. The dilatation itself is caused mostly by the loss of elasticity and tonicity but also by other factors such as increased pressure caused by cough and strain; accumulation of material in the cavity, and constant traction by the normal parts of the lung increased on inspiration. All these play important parts. This disease is not only found in adults but in children as well, usually following measles, influenza, whooping cough and various forms of bronchitis.

Bronchiectasis may be unilateral or bilateral, localized or diffuse, cylindric, saccular or fusiform. It affects the lower lobe only as a rule and the left more frequently than the right. The disease may be congenital or acquired.

*Symptoms:*

Chronic cough
Purulent expectoration
Weakness
Loss of weight
Fever
Clubbing of fingers
Night sweats

Physical signs

Rales localized chiefly to the base
Slight dullness
Amphoric breathing at times

The main symptoms are a chronic cough and purulent expectoration which at times is quite offensive, occurring most commonly in the mornings on arising. This is accounted for by the change in position as the cavities are at this time full and in turn cause dislodgment of the accumulated pus or material which excites coughing and expectoration.

At times, especially when the disease is advanced, blood is found in the sputum, and again acute exacerbation may come on, characterized by weakness, loss of weight, night sweats and fever. This is the dangerous time, as at this time a wrong diagnosis of acute pulmonary tuberculosis may be made. The clubbing of the fingers and toes is a late sign.

The physical signs are usually soft râles chiefly over the base; if the lung is indurated they are higher pitched and crackling. If a large dilatation is present the percussion note is dull while the cavity is filled, but when secretion is expelled and the cavity fills with air, the note becomes tympanitic.

*Diagnosis:* Diagnosis is not as a rule a matter of any great difficulty. It depends

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mostly on the expectoration of a large quantity of offensive putrid material, the greater part of which is pus, or the cough and physical signs.

*Roentgenography:* The most valuable aid to diagnosis is the injection of an iodized oil. At this clinic lipiodol is used. It contains 40 per cent of iodine, is obtained from poppy seed and is a stable vegetable oil. The fixed combination of the iodine with the fat renders it non-irritating, and is therefore tolerated by the mucous membrane of the respiratory tract as very little iodine is absorbed from this source. The oil is eliminated from the bronchial tree largely by cough and expectoration. Occasionally a great amount of oil is swallowed. If so, gastric lavage should be resorted to at once followed by a dose of castor oil because the iodine content is readily absorbed in the stomach mucosa. There are four methods employed in the injection of oil:

A. Supraglottic
B. Transglottic
C. Subglottic
D. Bronchoscopic

A. Supraglottic consists of allowing the warmed oil to flow through the glottis into the trachea.

B. Transglottic consists in introducing a flexible rubber catheter through the larynx and injecting the warmed oil.

C. Subglottic consists of passing a hollow curved needle through the cricothyroid membrane into the lumen of the trachea after first anesthetizing the skin and soft tissues. This method is employed mostly by the French.

D. Bronchoscopic. This method, I believe, is the most advantageous and is the one employed by myself. The bronchoscopic method allows the secretion present to be evacuated and, if the disease is bilateral, the oil may be placed on both sides equally well. Again, should any acute infection exist along the bronchial tree the endoscopy would detect it at once. For these reasons I believe this is the most useful of the four methods. The technic of the bronchoscopic method is as follows: the mucous membrane of the posterior pharynx is anesthetized with 10 per cent cocaine. The patient is placed in a partial upright position and instructed to breathe during the entire procedure. Then the laryngoscope and bronchoscope are passed. As the bronchoscope is placed in the upper trachea a small sponge saturated with 5 per cent cocaine is passed through the bronchoscope and the lining membrane of the trachea partially anesthetized. The bronchoscope is passed to the carina. If the left lower lobe is involved the bronchoscope is passed into the lower bronchus. Aspiration is carried out and should the condition be bilateral the same procedure is carried out on that side. After the secretion is removed, the warmed oil, 20 c.c., is passed from a large glass piston syringe through an aspirating tube. When a unilateral condition exists the entire amount is placed in at the same time; when there is a bilateral involvement, 10 c.c. are placed in each lower bronchus. Thus the bronchoscopic method allows another helpful procedure as equalization of oil can thus be had. The bronchoscope is now withdrawn following the injection of oil and the patient is taken to the *x*-ray rooms. The oil outlines with precision the size of the cavity formation.

The iodized oil also has a therapeutic effect in bronchiectasis, such as:

a. Lessening the amount of expectoration,

b. Reducing the number of bacteria in the sputum,

c. Lessening the toxic symptoms,

d. Reducing the size of the dilatation.

There are several contraindications for the injection of iodized oil:

a. Acute active tuberculosis,

b. Extensive advanced general pulmonary suppuration,

c. Angina pectoris,

d. Aneurysm,

e. Hemoptysis,

f. Cardiac decompensation,

g. Acute inflammatory involvement of upper respiratory tract.

In cases where tuberculosis is also suspected we use bromipin, which prevents fibrosis from occurring and is harmless to the lesion.

*Treatment:* First remove the definite etiological factor whether it be an infection or foreign body. Bronchoscopic aspiration should be carried out in each case, following the removal of the cause, as the majority of cases are only partially improved when the etiological factor alone is removed, which means that the patient will have symptoms for months or years thereafter. The benefit of this procedure is obtained by the aspiration of pus from the bronchi, followed by the injection of a medicated oil that acts as an antiseptic in the dilated air cells.

*Technic:* A laxative is given the preceding night with absence of food for six hours before the treatment. The patient is allowed to rest and one hour before, morphine sulphate, grain 1/6, is given hypodermically. When the patient arrives in the operating room his throat is anesthetized with 10 per cent cocaine solution which is followed in six minutes by placing the patient in position and passing the laryngoscope and bronchoscope. Aspiration is carried out by the aid of a small caliber aspirator with from 3 to 5 lb. of pressure. The aspirator is passed through the bronchoscope to the lower bronchi on either one or both sides. When the material is removed 10 c.c. of a solution containing:

| | | | |
|---|---|---|---|
| Monochloraphenol..... | grains | IX | 9 |
| Camphor..... | grains | V | 5 |
| Oil of geranium..... | gtts. | II | 2 |
| Olive oil..... | oz. | I | 1 |

are injected through a clean aspirator attached to a 20 c.c. Luer syringe. The bronchoscopes are withdrawn and the patient is allowed to cough. This scatters the oil into the small cavities and air cells, some being coughed up. Many patients will bring up particles of oil for from twenty-four to forty-eight hours.

This procedure is carried out at weekly intervals until complete relief of symptoms is obtained. In skilled hands the discomfort induced by this method is very slight as the patient starts for home about a half hour after the treatment.

*Postural Treatment:* This is second in importance on account of allowing drainage constantly. The foot of the bed should be elevated 18 in. whether the patient be in bed eight or twenty-four hours of the day. In conjunction with this, the patient should be instructed to lie over the side of the bed, so that the body is at right angles with the lower extremities for a period of ten minutes three times a day. I had one case where the patient became short of breath and cyanosed about three to five times a day. In this case immediate relief was obtained by placing the patient in the position mentioned before; that is, over the side of bed. This was followed by the coughing out of from 1/2 to 2 oz. of pus from the bronchial tree.

*Medical Treatment:* Medical treatment is used to empty the dilated tubes. Ammonium chloride which thins the secretion is used for making expectoration easier. Monochloraphenol solution, 2 per cent, in an atomizer for spraying of throat relieves the upper respiratory irritation. Tincture of benzoin inhalation also helps the lower bronchial tree irritation.

*Surgical Treatment:* Surgical treatments, such as thoracoplasty, lobectomy, cauterization, artificial pneumothorax and others, should only be used after all other methods have failed.

## CONCLUSIONS

1. Remove the etiological factor; secondly, treat the disease.

2. By the use of iodized oil bronchiectasis can be precisely and harmlessly diagnosed. The oil also has a beneficial effect on the condition.

3. Bronchoscopic aspiration and postural treatment are important for a cure.

4. No major surgical procedure should be done unless all other means have been tried without success.

[For Bibliography see p. 80.]

# A RESUME ON PROSTATISM*

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THE harmful misconception among the laity and the unwarranted attitude of pessimism prevalent in the minds of many medical practitioners when an old patient presents himself with classical symptoms of prostatic disease, urge me to review the subject in the hope that it may serve to correct such unfounded beliefs.

It has been estimated by dependable observers that 60 per cent of all men who have entered upon the last epoch of life possess abnormal prostates, particularly of the hypertrophic type, greatly enlarged prostate gland, or the atrophic "small contracted scar tissue type," hence the nomenclature prostatism. Therefore, when a man who has attained the age of fifty years or over, of apparent good health, observes that the urinary stream has diminished and consumes more time during the reflex and urinates more frequently and particularly during the night, the suspicion of prostatism is well founded. A slight burning sensation usually accompanies urination (initial stage). Catheterization of such an individual discloses the fact that the urinary bladder has not emptied completely. What has not been voided is known as residual urine. In the beginning the quantity is small (stage of incomplete retention), but with the years there is an augmentation of these symptoms until micturition becomes a dreaded ordeal and the quantity of urine voided is practically nil (stage of complete retention).

By practicing digital exploration of the gland one notes that it is either greatly enlarged or of the atrophic sclerotic type. One must also remember that in some cases the enlargement may be intravesical which is demonstrated only by a cystoscopic examination. The digital examination therefore is confirmatory only, never absolute.

In a certain number of cases the initial symptom may be an accidental acute complete urinary retention in the interim of apparent good health. This type of retention may not reappear for years after being relieved. In other cases it may assume the intermittent character particularly if the individual is prone to irregular habits. In the majority of cases, however, the disease progresses slowly and with it many complications follow that undermine the patient's vital powers.

The following are the usual complications: cystitis, pyelonephritis, renal sclerosis, urosepsis local or general, prostatic hemorrhage, prostatic abscess, debility of vital organs as a result of the constant presence of pus organisms.

Under the aspect of surgical treatment, the complete removal of the obstructing gland must be considered as the ideal cure. We are indebted indeed to Squier of New York under whom I had the privilege and pleasure of studying the progress made in this surgical field, i.e., transvesical prostatectomy. At the present time this procedure has a mortality of 5 per cent.

In every surgical case the attending surgeon must decide his modus operandi according to the degree of disturbance. Cardiac pulmonary blood and renal function tests are to be utilized. At the present time there is no need to treat these prostatics hurriedly and blindly.

If the creatinine and blood urea particularly are in excess and do not become better after preliminary catheterism, the patient should not be operated on. On the other hand, should the investigation prove scientifically conclusive, then surgical intervention is justified.

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# RELATION OF THE ROENTGEN WAVE LENGTH TO THE BIOLOGICAL EFFECT*

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In the field of roentgen rays, recent years have brought forth some interesting studies, in the effort to solve the problem of the biological effectiveness of roentgen irradiation as regards the quality of the rays used. The school of Holthusen[1] has devoted special attention to the solution of this problem. Holthusen himself has taken up the subject and comes to the conclusion, that an influence on the course of the mortality curve for Ascaris ova cannot be determined by a varying quality of the rays. Determann[2] (together with Jacobi and Holthusen) arrived at the same conclusion in an older publication. The studies of the school of Holthusen go back as far as Volumes 26 and 27 of *Strahlentherapie* and the studies appearing in these volumes on the erythema formations in the human skin have arrived at about the same result.

But inasmuch as, on the one hand, a great many authors arrive at the conclusion of the independence of the biological effect from the quality of the rays, and, on the other hand, a number of prominent radiologists have obtained contrary results, we, in this article, shall attempt to correlate the most important publications of this nature and their partially varying results. Naturally, we will not cover all of these studies, but will rather limit ourselves to the studies which are apparently the most important, the conditions of their experiments, and their conclusions.

In an abstract on the occasion of the Second International Roentgen Congress we have expressed our opinions on the work of Hess[3] and Determann.[2] Now we shall briefly discuss their work. The following Tables (I and II) were compiled from the studies of these authors. If one presents the results of Table I graphically, according to the applied dose depending upon the primary quality of the rays, which we characterize as the so-called half-value layer of copper according to the proposal of Holthusen, one distinctly sees, that even with the observation material of Hess there is a definite dependence upon the quality of the rays. In Figure 1 we present the results graphically.

Table I

ACCORDING TO HESS

| Tension and Filter | Half-value Layer of Copper | R-number of Primary Radiation for Fields | | |
|---|---|---|---|---|
| | | 1.5 by 1.5 | 6 by 8 | 15 by 15 |
| 185 kv.<br>1 Cu<br>1 Al | 1,32 (1.39) | 680 | 540 | 485 |
| 180 kv.<br>0.5<br>1.0 Al | ..... | 720 | 575 | 515 |
| 145 kv.<br>2.0 Al | 0.28 | 710 | 590 | 548 |
| 110 kv.<br>2.0 Al | 0.15 | 690 | 575 | 530 |
| 110 kv.<br>1.0 Al | ..... | 700 | 580 | 540 |
| 60 kv.<br>0.5 Al | 0.08 | 750 | 680 | 625 |
| 60 kv.<br>..... | | 750 | 680 | 625 |

On the basis of a comparison with the quality values of Table II, we have coördinated the individual primary qualities used by Hess with the half-value layers for copper given in the second column of Table I. Because of the recently reported dosage table of Grebe,[4] we have added the more accurate value for the first irradiation and have added the latter to Figure 1.

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In the upper curve Figure 1 shows the relationship between applicable roentgen values in R and the half-value layer of the

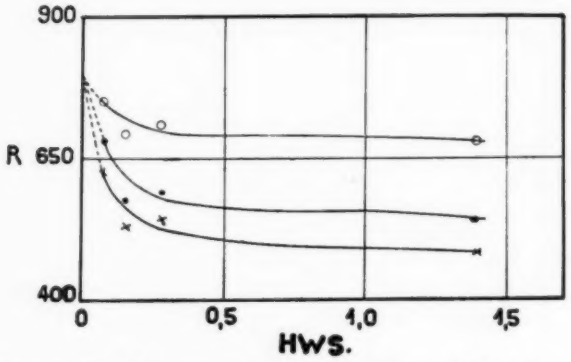


FIG. 1. Graphic presentation of results of Hess from Table 1.

primary radiation for the smallest field of irradiation; the lowermost curve shows the corresponding ratio for the largest field, 15 by 15 sq. cm. *A dependence in favor of the harder rays is very apparent, inasmuch as for the latter a smaller number of the roentgen value in* R *is necessary to reach the same biological effect.* There is something else that can be read from these curves. It appears that the three curves can be easily continued to 800 R. This indicates, that, practically, with a very soft irradiation, in which the secondary rays can be neglected both quantitatively and qualitatively, 800 roentgen units must be applied in the three fields of different sizes in order to reach the biological effect of erythema formation.

From the second table of Determann there is then seen from the comparison of the total cases (last column) a strikingly good conformity of the biological effect with the use of different qualities (hard and soft). This result, however, takes on a different aspect when one considers the last horizontal row of this table. Here the periods of irradiation for the different qualities, hard, soft, are compared with each other. This can, naturally, be taken to mean only that the focus-surface distances are varied in such a way, that the intensities impinging against the body surfaces were in accordance with the different qualities. If one excludes the one high value of Glasser, one obtains the ratio of 0.9. *This means that the periods of irradiation for the same irradiation intensities are somewhat shorter for hard rays, which corresponds with Figure* 1. *A complete reversal obtains, however, when one considers the Glasser value as* 4.38. *The new medium value is then* 1.47, *which is very much in favor of the soft radiation.*

TABLE II

ACCORDING TO DETERMANN

| Kv. | Filter | Half-value Layer Mm. Cu | Determann | | Glasser | | Schreuss Schönholz | Klein and Gärtner | Total Cases |
|---|---|---|---|---|---|---|---|---|---|
| 64 | Carton | 0.06 | .... | .... | .... | 2(2) | .... | 4(4) | 6(6) |
| 64 | 3.0 Al | 0.09 | 2 | .... | .... | .... | .... | .... | 2 |
| 85 | 2.0 Al | 0.12 | .... | 4 | .... | .... | .... | .... | 4 |
| 130 | Carton | 0.15 | .... | .... | 7(2) | .... | .... | .... | 7(2) |
| 110 | 3.0 Al | 0.18 | .... | .... | .... | .... | 2(2) | .... | 2(2) |
| 160 | 3.0 Al | 0.30 | .... | .... | .... | .... | 2(2) | .... | 2(2) |
| 130 | 0.5 Cu 1.0 Al | 0.60 | .... | .... | 7(2) | 2(2) | .... | .... | 9(4) |
| 156 | 0.8 Cu | 0.86 | .... | 4 | .... | .... | .... | 4(4) | 8(4) |
| 186 | 1.0 Cu 1.0 Al | 1.32 | 2 | .... | .... | .... | .... | .... | 2 |
| Hard, more effective than soft | | | .... | 2 | .... | 1(1) | 1(1) | 3(3) | 7(5) |
| Soft, more effective than hard | | | 2 | .... | 4(1) | 1(1) | .... | .... | 7(2) |
| Hard and soft, equally effective | | | .... | 2 | 3(1) | .... | 1(1) | 1(1) | 7(3) |
| Relation of the radiation periods: Hard: soft | | | 1,175 | 0.887 | 4.38 | 1.06 | 0.44 | 0.87 | |

At different times we have called attention to the fact,[5,6] that it is not feasible to use the primary radiations in comparison with the biological effect. The secondary radiations (electronic and wave radiation, insofar as concerns the formation of electronic radiation within a certain volume), which are the biologically effective ones, possess effective energy values, which are considerably less favorable as compared with those of the primary radiations. In addition, they are almost similar, even with the softest and hardest primary radiations employed by the authors mentioned. In Table III we present a compilation of different radiation qualities, namely, first, those of the primary bundle, then of the purely secondary radiation and, finally, of the total radiation, always expressed by the effective wave lengths.

Table III

Compilation of different primary and secondary qualities

| No. | Tension in the Tube (Kv.) | Filter in Mm. | Primary Effective Wave Length in A. Units | Secondary Efficient Wave Length in A. Units | Total Effective Wave Length in A. Units |
|---|---|---|---|---|---|
| 1 | 85 | 0.5 Al | 0.280 | ..... | 0.264 |
| 2 | 124 | 2.0 Al | 0.229 | ..... | 0.212 |
| 3 | 151 | 4.0 Al | 0.206 | ..... | 0.194 |
| 4 | 176 | 0.5 Cu | 0.155 | 0.179 | 0.163 |
| 5 | 176 | 1.0 Cu | 0.145 | 0.176 | 0.160 |
| 6 | 176 | 3.0 Cu | 0.118 | 0.174 | 0.138 |

In the next to the last column of Table III we have not given any secondary wave lengths for the first three-ray qualities, as the former differ from the primary qualities only slightly. Nevertheless one sees, that the total radiation has a different quality from that of the primary radiation. The hardening of the radiation lies in the filtering effect of the uppermost layers of water, in which the ionization chamber with its relative large surface was placed.

In Table III, irradiation No. 4 shows distinctly that the secondary radiation is far behind that produced by primary radiation as regards its quality. In addition, one sees that the individual secondary radiation qualities differ among themselves relatively little, whereas the corresponding primary radiations differ considerably from one another.

Under such conditions, can we expect to find any difference in the biological effect? According to our opinion, only when the biological test object is sensitive enough. But inasmuch as we must generally deal with results that can vary 10 per cent from one another, we must not be surprised if there is an apparent independence of the biological effect from the radiation quality. The objection also, that the total radiations of the first three types of rays in Table III as well as secondary radiations, of which the last three qualities are quite different and therefore an effect in the biological effectiveness could be expected, does not appear to us to be valid, as we have already shown on another occasion. In a forthcoming article in *Strahlentherapie* we again show, that only the number of electrons deserves consideration in the calculation of the different qualities. When one considers the different absorbabilities, one finds it is almost the same in the different qualities of Table III. The differences, which actually appear to favor the softer radiations, are within the biological accuracy of the reaction. If one had at his disposal the primary qualities produced as secondary qualities, a distinct difference would probably have come to light. We, therefore, believe that still more penetrating primary radiations than are generally used today are necessary to finally decide this question. That still other investigators hold the same opinion is shown by the fact that various firms that are manufacturing roentgen outfits are beginning to produce apparatus for 400 and more kilovolts.

How about the latest work of Braun and Holthusen in this respect? We distinctly state at this time that we do not in any way wish to minimize the excellent works of the Holthusen school and the other authors cited. We are only concerned with shedding some light on the subject in

question from all sides and to subject all the factors, which are necessary for further development, to criticism.

The authors mentioned extend their experiments to Bucky's grenz rays and ultraviolet rays and conclude that there is no relationship between the biological effect and the wave length.

As compared with the works previously discussed, the field of observation as regards the soft radiations is quite extensive, but naturally this has nothing to do with the deeply penetrating radiations. We have been able to show that a further increase of the quality (see Table III, irradiation No. 6) does not result in any difference in the biological effectiveness on sprouting beans, but we have also mentioned at the same time, that the truly biological effective radiation in its quality was improved very slightly. At any rate a slight systematic change not in favor of the harder radiations was demonstrable, but this does not at first effect the fluctuations in the biological reaction power. In this same work,[5] we also spoke of another effect which, in our opinion, has not been given sufficient consideration up to the present time.

If, for example, one considers a volume of tissue lying immediately under the skin, the biological reaction is produced by the absorbed amount of energy within the volume. This energy is mostly attributable to secondary phenomena, namely, both the electronic radiation and the wave radiation in their reciprocal relationships. If one imagines this assumed volume to be surrounded by an extremely thin, non-absorbing wall, a certain amount of the radiation will escape from the assumed volume, but others will enter into the observed volume from the immediate surroundings.

The energy that is disseminated into the volume is the greater, the greater the primary energy. If one then imagines this volume to be replaced by a small chamber that is unaffected by the wave lengths and measured off into ray units, and if one treats this chamber within the irradiated tissue alternately with a soft and then a hard radiation, the same number of rays will be measured for both qualities of the rays by the same number of electrons produced in the chamber. In this way there naturally prevails a balance between the energy lost by the early penetration into the chamber wall and that of the electrons brought out of the chamber wall by the photographic effect. This requires the definition of the measuring chamber that is unaffected by wave length on the basis of the radiation unit definition of Behnken. Naturally, the radiation that will escape from such tissue volume cannot take part in the estimation, because this radiation with its assumed equally large chamber in the wall of the same, loses its effectiveness and is absorbed.

But how about the radiation coming from without? This admittedly is composed of an electronic radiation and a secondary wave radiation. The latter will penetrate the chamber wall as well as the extremely thin and non-absorbing wall of the tissue volume, which was assumed before. Naturally, both the material and the thickness of the chamber wall then provide at first uncontrollable conditions, both of which, however, act in the same direction. Inasmuch as a metal (silicium) is added to the carbon chamber so as to annul the effect of the Behnken chamber wall, the entering wave radiation will reach the chamber in a weakened state. The thickness of the chamber acts similarly, so that the presence of a greater energy in the tissue volume must be taken into consideration than is calculated by the measurement.

In addition to the wave radiation there exists also the electronic radiation from the immediate vicinity of the chamber. Of this, nothing reaches the interior of the chamber, because even the most rapid electrons exhaust themselves in the wall. In tissue, therefore, all these electrons, which do not appear in the calculation with the ionization chamber, will be able to exert their influence.

*What, then does one measure in the chamber? The same number of electrons with different secondary ray qualities; but with the harder radiations, exclusive of the electrons penetrating into the volume under consideration from without, and in all cases the wave radiation directed, though weakened, from without toward the interior of the volume. This effect is the greater, the more penetrating the primary radiation and also the more energetic the secondary radiation.*

The result is, that with hard radiation in the tissue volume observed the same number of electrons is manufactured for the production of the same biological effect as with soft radiation, that the previously mentioned radiation effects are superimposed upon the effects of these electrons, and that in reality a large dosage of effective radiation is applied. From this one must conclude, that so long as the electrons are counted in the calculation of the applied dosage, the harder radiation is the less effective.

This produces no change in the calculation of the primary energy in the reception chamber. Here only the primary qualities and quantities are compared with each other, that are necessary to achieve a certain biological effect certainly with an entirely different quality and quantity. So long as the secondary energies do not differ too much from one another, a comparison of the primary qualities is also possible. But it is doubtful whether the Bucky grenz rays are not too far removed from the softest roentgen radiation as regards the secondary effective wave length. This also applies particularly to the ultraviolet radiation. Even though Braun and Holthusen in their work find no influence on the course of the curve of injury with the use of different radiation qualities, these facts do not definitely lead to the conclusion that hard rays are just as effective as the soft rays. At any rate, the influence of the chamber grenz effect mentioned here and elsewhere must first be confirmed by experiments in order to show that there is a noteworthy effect upon the dosage.

Finally, we would like to raise another question as regards the radiation with ultraviolet light. It is a well known fact that the wave lengths of this field of radiation are absorbed by very thin layers. If the uppermost layers of the Ascaris ova were not or only slightly permeable to ultraviolet light, the question, as to what the actually effective factor is, would be justified. Undoubtedly, the visible light originating in the burner also has an effect upon the ova, and one could imagine a superimposition of several effects.

We would like to call attention to another phenomenon, which may have an influence upon the results of Holthusen in his graded experiments. We refer to the change in the quality of the primary radiations with a varying focus-surface distance. We have found, that when measurements of the quality of the radiations are made according to the method of Duane, as repeatedly described by us, with different focus-surface distances, the quality that reaches the measuring chamber varies. The school of Holthusen has also conducted some measurements of quality, in which an aluminum chamber was placed over the thimble chamber, by means of which the total radiation quality could be determined by two measurements of intensity. For a long time we have used a 1 mm. thick copper chamber and have determined the purely secondary radiation of different primary qualities both quantitatively and qualitatively. For the investigation of the change in quality with distance, we have, for the sake of simplicity, measured the entire bundle of rays once without the copper filter mentioned and once with it. The secondary radiation reaching the chamber from the relatively large volume of water or air, respectively, which lies in the immediate vicinity of the chamber, is not changed by the action of the open beam of light; only the quantity and the quality of the radiation which is reflected upward immediately under the chamber

undergo a change, as altogether a filter of 2 mm. thickness must be permeated by the primary radiation. The portion of the reflected radiation reaching the chamber from this volume, however, is so slight as compared with the entire reflected radiation, that it has no special significance and, therefore, the results obtained may be considered as nearly correct. At any rate the striking difference of the different qualities cannot be explained by this alone.

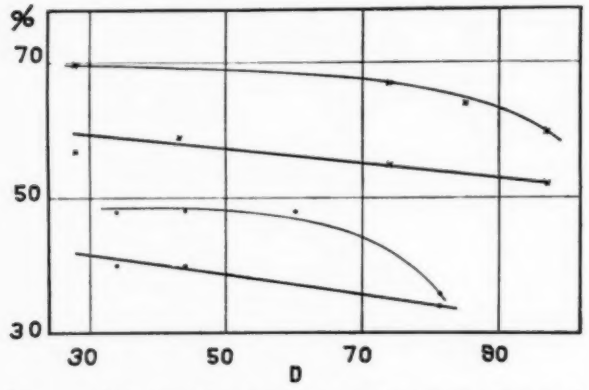


Fig. 2. Relationship between radiation quality and focus-surface distance, with and without influence of water.

The curves in Figure 2 show the differences between the qualities measured in this way. In the measurement with water, the measuring chamber was placed half in the air and half under water. In the measurement without water the chamber remained in the same place.

The following tables show the experimental details and indicate that the primary radiations used were fairly penetrating. It is interesting to observe that without water curves are obtained which, at a distance of about 60 cm., approach a straight-lined course, and that practically at a distance of less than 40 cm. an essential change in the quality is no longer demonstrable.

In the presence of water there is observed an absolutely straight-lined course of the relationship between the quality and focus-surface distance. It appears, however, that even with a distance of 30 cm. a constant quality is not obtained at the surface. We attribute this phenomenon to both a spreading of the primary radiation into the air and to a spreading to neighboring objects with tubes which are not absolutely closed. The fact that the qualities in the presence of water are generally less than those that are obtained without water is due to the conditions of spreading in the water alone. The main figures in the last two columns of Tables IV and V are percentages of the radiations that can still penetrate through 1 mm. of copper, and the figures in parentheses are the effective wave lengths that are obtained by Duane's curve.

In their work, Holthusen and Braun report that in the graded experiments at different distances from the anticathode the intensities showed a ratio of 1:10 and that the smallest distance was 20 cm. The greatest distance must have been 63 cm. But in addition there is possibly also a change in quality, so that the different

Table IV

Measurements of Quality with 3 Mm. of Copper Filter at Different Distances

| Focus-surface Distance, Cm. | Percentages of the Radiation that Still Penetrate 1 Mm. of Copper. The Corresponding Effective Wave Lengths in Parentheses | |
|---|---|---|
| | Without Water (A.U.) | With Water (A.U.) |
| 97 | 60.4 (0.130) | 52.3 (0.143) |
| 85 | 63.8 (0.122) | |
| 74 | 66.7 (0.118) | 54.6 (0.142) |
| 60 | 68.5 (0.114) | 55.0 (0.142) |
| 43 | ..... | 58.6 (0.134) |
| 28 | 69.6 (0.112) | 57.0 (0.138) |

Table V

Measurements of Quality with 0.5 Mm. of Copper Filter at Different Distances

| Focus-surface Distance, Cm. | Percentages of Radiations that Still Penetrate 1 Mm. of Copper. The Corresponding Effective Wave Lengths in Parentheses | |
|---|---|---|
| | Without Water (A.U.) | With Water (A.U.) |
| 81 | 36.0 (0.174) | 34.0 (0.179) |
| 60 | 47.5 (0.153) | 36.0 (0.175) |
| 43 | 48.0 (0.153) | 40.0 (0.166) |
| 34 | 48.0 (0.153) | 40.0 (0.166) |

portions of Ascaris ova were irradiated for the same period of time in order to eliminate the influence of the time but yet with different qualities. What are the conditions, in addition, in the graded experiments with the unequal distribution of the intensity prevailing within the field of irradiation?

This work with hard and very soft roentgen rays and rays that reach into the realm of ultraviolet and visible light is in contrast with the work of Packard, who extends his investigations up to the gamma rays of radium emanation and comes to the same conclusion the independence of the biological reaction from the wave length. The same author also contributes another work,[8] in which he reports on experiments with roentgen rays of different wave lengths. The wave lengths selected by him include 0.2, 0.5 and 0.7 Angstrom units, and fall in the realm of radiations for which some authors claim a greater biological effect. In the gamma ray experiments of this same author the radiation reaching the Drosophilla larvae is, in our opinion, not absolutely freed of beta rays. On the contrary, electrons of considerable energy are liberated from the hard rubber, which serves as a partition between the larvae and the emanation apparatus, and from the paper, which serves as a carrier of the larvae, which electrons must reach the larvae in part. We readily admit that just as with the gamma radiation, it is exceedingly difficult to get rid of the influence of the electrons; but this does not prove that there is an independence between the biological effect on the one hand, and the wave length, on the other. If one thinks only of the effect of the total radiation as liberated from that of the beta radiation, some other curve would have to result, or else the relationship of the millicurie-minutes to the roentgen units would have been different from what is shown by the figures of the author. In this respect, also, the direct report of the radiation energy in roentgen units reaching the ova would have been more purposeful.

As already mentioned, there then appears a work[5] by us which takes up the same problem. We have used as our test object the Vicia faba bean, which has also been used successfully by other authors. We readily admit the correctness of the objection of Holthusen, that a bean reveals a large number of different cells in the root, which is the part most sensitive to radiation, and that the desired effect must appear as a medium value in the result. If we except various individuals with a markedly varying reaction, which we have never been able to observe in our experiments, we recognize in this medium value, as is assumed by Holthusen, the very evidence, that different cells react differently to the same quality of radiation.

In our experiments, we have also found a greater sensitiveness in the realm of the soft rays, corresponding with the results of Glocker.[9] We would again like to repeat that the pure secondary radiations of the radiation mixtures employed by us differed very little from one another in their effective wave length. We have also mentioned why this must be the case. We were also able to show mathematically, that an essential difference in the biological effect cannot be expected, just because of the slight difference in the quality of the secondary radiations. If, however, a difference does appear, it may well be assumed that the same will prove to be more pronounced with still greater differences in the quality of the secondary radiations. If we also consider the chamber-grenz effect mentioned previously, we would have to all the more obtain a lesser biological effectiveness in the realm of the hard rays.

All of the experiments reported heretofore, in our opinion, apply only to the test objects used at the time, which showed markedly different sensitiveness to the radiations. In order to obtain the same biological effects very much larger doses are required for Ascaris ova than for beans which, again, are more sensitive than the human skin. It appears important to us that these experiments should be repeated under

absolutely clear physical conditions on as many test objects as possible. Finally, it must not be forgotten, that even with the smallest test objects the primary radiation is disseminated and hence the effective energy is changed. The exact determination of this effective quality is the basis for the determination of the relationship between the radiation quality and the biological effect.

In summary, it may be said that the previously published reports that have endeavored to determine the effectiveness of various radiation qualities in human skin are not sufficiently convincing, as the effective radiation qualities are entirely different from the corresponding primary qualities and also are hardly any different from one another. The reports of different authors (Glasser and many others) on the necessary roentgen units with Bucky grenz rays seem to show the opposite of the school of Holthusen's conclusions.

This applies also to the experiments on Ascaris ova, or Drosiphilla larvae, or sprouting beans, in which secondary radiations that are different from the primary radiations, also come up for consideration. It is still undecided, which are the effective qualities that act upon the sensitive portions of the cell with irradiation with grenz rays and ultraviolet light. The presence of a part of the visible light in the quartz lamp, particularly, provides uncontrollable conditions. The experiments with hard radium rays also do not yet seem to be sufficiently certain because of the effect of the secondary beta rays.

The slight dependence on the quality of the radiation in favor of the soft radiation in small doses determined by Glocker, is confirmed by us in a work published during the same year.

When it is a question of measuring the intensities with a small chamber on the surface of the water, where a definable quality prevails, which is also effective on the small object of the Ascaris ovum, and when these objects are exposed to the corresponding qualities on the surface of the water, a chamber-grenz effect may appear, which admits of a change of the independence found which is not in favor of the hard rays.

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# NEW INSTRUMENTS

## MODIFIED CANNULA FOR URETHRAL INSTILLATION*

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HORNELL, N. Y.

THE instillator, which consists of a syringe to which is attached a hollow sound, is used frequently in the treatment of urethritis. When properly manipulated this sound, or cannula, is inserted into the urethra until its tip is just beyond the cut off muscle and the selected medicament is injected into the posterior urethra. The tip should not be introduced into the prostatic urethra. If so desired a portion of the same medicament may be deposited in the anterior urethra as the instrument is withdrawn.

FIG. 1. Instillator cannula as manufactured. (Drawn to scale.)

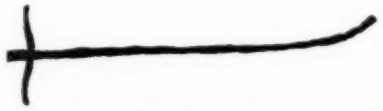

FIG. 2. Suggested modification of cannula. (Drawn to scale.)

The cannula most commonly sold is 13 F. in diameter, rather small and too pointed for safety, and has an acute curve over which a (usually) tender and inflamed anterior urethra must be stretched. This curve is such that the tip hugs the urethral roof so closely that frequently the membranous urethra is entered without the characteristic jump of an instrument passing the cut off muscle, so the operator, forgetting that the pars membranacea is but 1.5 cm. long, is apt to insert the sharp tip well into the prostatic area and thereby invite those complications of urethritis most to be avoided.

It seemed probable that a cannula of this size (13 F.) with a less acute flexure would traverse an inflamed anterior urethra with less trauma and that such relation might be established between the curve and the shaft as would indicate approximately the location of the tip when the instrument is in the urethra. Herewith is presented a modification of the instillator cannula which may be had by anyone who will merely straighten the curve thereof according to the illustrations. Its contour assures quite accurately that with the patient supine and the cannula in situ for use, when the shaft is in a vertical position the tip will have entered and will rest within the membranous urethra.

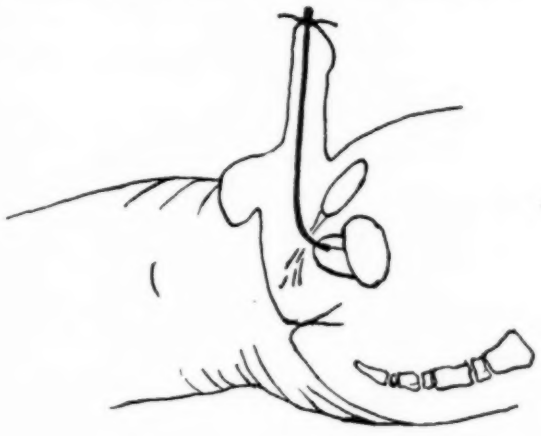

FIG. 3. Cannula as manufactured, showing tip within prostatic area when shaft is vertical and patient supine.

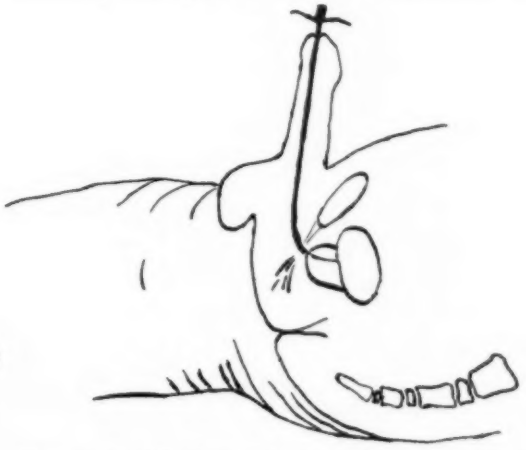

FIG. 4. Modified cannula in position for use, showing tip to be within membranous urethra when shaft is vertical and patient supine.

* Submitted for publication May 6, 1930.

# CASE REPORTS

## CALCULI IN ECTOPIC KIDNEY*

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NEW YORK

MR. R. entered the Urological Department of the New York Hospital on February 24, 1930, complaining of pain in the right hip and right leg. The family history was irrelevant.

*Past History:* He has always been well except for a bilateral herniotomy eight years previously. He had another herniotomy for recurrence on the right side one year later. History of venereal disease denied.

*Present Illness:* Began four months ago with pain in the right leg. Four weeks later the pain spread to the back of the thigh and then to the right hip. This has been continuously present since that time. About one year ago, he had pain on urination lasting three months. Two weeks ago this dysuria recurred but stopped a few days later following cystoscopy.

*Physical Examination:* Showed a slightly built man who appeared to be fifty-five years of age, fairly well developed, and rather poorly nourished. There were two scars in the right inguinal region and one in the left groin. The splenic dullness appeared to be on the right side and the area of the liver dullness on the left side. The heart was transposed, being on the right side. Otherwise the heart was normal. Blood pressure 114/78. Rectal examination showed the prostate to be enlarged to two and one-half times the usual size, boggy in consistency. Six ounces of residual urine were obtained. Reflexes were normal.

The interior of the bladder showed a moderate amount of edema and congestion, especially in the region of the trigone. The right ureteral orifice was somewhat edematous and enlarged. No. 6 catheter passed to the renal pelvis on each side, without difficulty. Specimens were taken from each side for urea, microscopic and culture. An intravenous phenolsulphonephthalein test for renal function was done. X-rays were taken before and after injection of sodium iodide into the right renal pelvis, patient being in the prone and erect postures, the catheter being withdrawn in the latter position. The specimen from the right kidney showed 17 g. of urea, and that from the left side 21 g. per liter. Phenolsulphonephthalein appeared in five minutes from each kidney and in ten minutes the left kidney excreted 13 per cent and the right, 5 per cent, of the dye.

*Results of X-rays:* Left kidney shadow was seen to be low in position. The right kidney was ectopic, located on the promontory of the sacrum where there were two shadows, one about the size of one's thumb, and one about the size of the end of one's index finger.

*Right Pyelogram:* Showed a filling defect at the points where the previously mentioned shadows were noticed. A diagnosis was made of calculi in ectopic kidney and it was suggested that the calculi be removed under regional anesthesia.

Preceding operation, his blood urea nitrogen varied from 8 mg. to 20 mg. His blood sugar was 120. The Wassermann test was negative. His urine showed the presence of a faint trace of albumin and a moderate number of pus cells in the urine. Cultures of the bladder urine showed the presence of B. proteus. Otherwise the urine showed nothing of interest. On February 5, he was operated on under paravertebral anesthesia, 1 per cent novocaine being used.

A golf stick incision was made and extended down to the peritoneum. The original intention was to do an extraperitoneal operation but it was found that there were numerous peritoneal adhesions due to two previous right herniotomies, so that it was decided to do a transperitoneal operation. The parietal peritoneum was incised and the intestines were displaced with gauze packs, exposing the right kidney which was in the region of the promontory of the sacrum.

The stones could be palpated before the posterior layer of the peritoneum was incised.

* Submitted for publication August 2, 1930.

It was thought best not to attempt to remove the kidney, but to do a nephrotomy for removal of the calculi. The incision was then made through the posterior layer of the peritoneum, over the region of the larger of the two calculi. The calculi were easily removed after a little exploration with the index finger. The kidney was not enlarged and was fixed in position very firmly. A few small aberrant blood vessels were noted.

A soft rubber catheter was placed in the nephrotomy incision. Surrounding this catheter six cigarette drains were placed down to the kidney. Following this operation, his temperature was normal for ten days except that on the sixth day postoperative it rose on one occasion to 102°F. He suffered but very little discomfort during this time.

The cigarette drains were removed in one week and the catheter was withdrawn about 1 in. daily, until it was removed on the twelfth day postoperative. On the thirteenth day postoperative, his temperature suddenly rose to 104.6 and from the thirteenth day postoperative to the twenty-sixth day postoperative, he ran a temperature fluctuating from 98 to 105.4°F. Daily variations in temperature were quite marked. No cause for this elevation of temperature was found outside of the urinary tract. The abdomen was moderately distended, and the blood count twenty days postoperative was 20,000. It was decided on the twentieth day postoperative to do an intravenous pyelography. A uroselectan urogram showed fairly well the outline of the left renal pelvis and ureter, but the right side was not visualized. It was decided that the right kidney should be explored in an attempt to remove the cause of the continued fever. This was done on March 18. A left rectus incision was made, the peritoneum opened, the intestines packed off, exposing the region of the ectopic kidney. The kidney felt somewhat fluctuant. A small incision was made in the surface of the kidney but no free pus was obtained although the entire kidney was boggy. A rubber catheter surrounded by five cigarette drains was inserted in the region of the incision. The left kidney was also palpated and nothing abnormal found. The wound was closed and the patient returned to his room in good condition. Following the second operation, the temperature remained considerably elevated for a period of one week, when it became approximately normal.

One week following the second operation, his condition appeared markedly improved, and he began sitting up ten days postoperatively. Four days later he left the hospital in very good condition. Weight before admission to hospital, 111 lb. Weight upon discharge from hospital, 91 lb. Weight at present, 116 lb.

# SUBLUXATION OF THE HEAD OF THE FIBULA*

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NEW YORK

LYLE, in 1925, collected 41 cases of this simple but uncommon dislocation of the head of the fibula. Three new cases have been recorded in the literature, those of Hall, Hogenhauer and of Lemprière. To these I wish to add another.

*Case.* E. T., a boy, aged seventeen, referred to me by the Welcome House Settlement, was seen on December 3, 1929, because of the presence of a bony prominence on the outer side of his right knee. While running in a 60 yard dash last June, he thinks he may have twisted the foot or leg. He is definitely not sure of this. He noticed a dull pain and stiffness in the knee the day after the race, and these symptoms lasted a few days. Since then, he has noticed the prominence of the fibular head. At times, he has a certain amount of stiffness in the knee, together with a feeling of insecurity. When pain is present, it is dull and located between the head of the fibula and the tuberosity of the tibia, never in the knee-joint proper. However, he has been able to carry on athletic work.

Examination of the right knee shows an increased prominence of the fibular head, as compared with the normal left side. Motions in the upper tibiofibular joint (always slight) are increased, the leg being used as a long arm lever. Motions of the knee are normal. As the knee moves from full flexion to full extension, the head of the fibula is seen to subluxate forwards and outwards at 90° flexion, and to remain so until 160° extension is reached, when it reduces itself. There is definite and marked tenderness over the head of the fibula, when it is subluxated; none when it is self-reduced. There was no injury to the external popliteal nerve. A roentgenogram of the affected knee was negative.

An elastic knee-cap with a circular belt and buckle arrangement, sewed on, was advised to hold in the head of the fibula. However, the patient refused any treatment.

It is possible that the tearing or stretching of the external joint capsule, while the boy was running, was due to a strong inadvertent, inward rotation of the leg, with inversion of the foot, the knee being extended.

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*Submitted for publication April 23, 1930.

# HYPERTROPHIC PULMONARY OSTEOARTHROPATHY

## (BAMBERGER-MARIE DISEASE)

## REPORT OF A CASE FOLLOWING INTRATHORACIC MALIGNANCY*

CALVIN B. RENTSCHLER, M.D.

READING, PA.

MARCH 13, 1929, P. Z., an adult male, aged forty-four years, a moulder by trade, was admitted to the Reading Hospital.

### HISTORY

The patient was apparently well until nine months ago, when he noticed a small lump on the right side of his neck. Almost immediately he went to his physician, who told him that he needed a tonsillectomy, which was performed. The operation, done at a neighboring hospital, was uneventful except for probably a little more than the average tendency to bleed

* Submitted for publication April 23, 1930.

from the right side. The patient went back to work but soon noticed that his extremities became swollen. The swelling was first seen

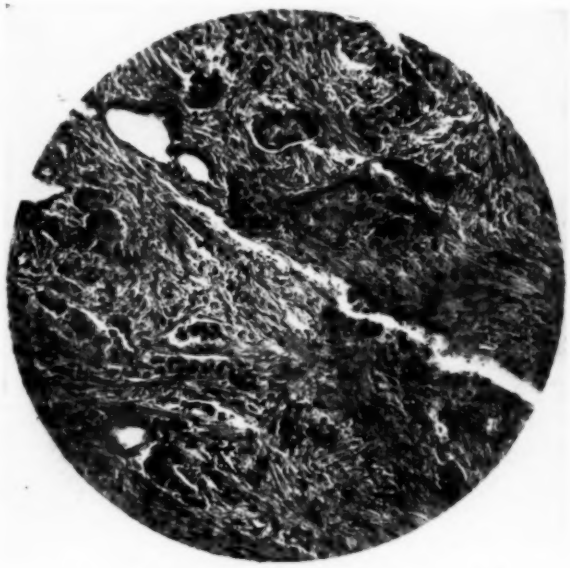

Fig. 1. Adenocarcinoma, grade IV (× 160).

in the hands and feet but very soon he noticed that his knees and all the joints of his extremities seemed enlarged. There was no pain. He showed his enlarged hands to his boss, who told him that he was not going to live much longer and that he should stop work and go to see his doctor. The swelling in the neck became gradually larger, and as time went on it became slightly tender. His extremities enlarged to the extent that his hands were noticed by every one, and whereas, he used to wear a number eight shoe he now needed a number twelve, and these were too small.

He had had a cough for seven or eight months, which had not given him much annoyance, but recently it seemed to have become more severe. There was no coughing at night. At first, there was no expectoration; however, as time went on there was slight clear mucous expectoration. Work seemed to aggravate the cough.

His appetite was good. No particular type of food disagreed with him. The bowels moved quite regularly.

Urination was normal. The patient did not have to get up at night for anything and slept quite well.

There were no worries except that he was used to work and wanted to go back on the job as soon as he was able.

There was no history referable to the special senses. Hearing was good and so was vision. There were no headaches, disturbances of vision or drowsiness.

Fig. 2. A field from Fig. 1 (× 860).

The patient's weight, as a rule, had been 155–160 lb. The weight on examination was 131 lb. Blood pressure, systolic 116, diastolic 66.

Gradually he began to lose strength and had pain not only in the mass in the neck but also in the extremities, as well as through his chest. He was admitted to a neighboring hospital and the mass in the neck was explored January 12, 1929, (Oscar Fox). A vertical incision curved posteriorly at the upper end was made over the growth and the flaps dissected back. The growth was very extensive, attached to important structures such as the carotid sheath, the parotid gland, sternocleidomastoid muscle and also involved the spinal accessory nerve. Removal was impossible. A piece was removed, and after a histological study, a diagnosis of adenocarcinoma grade IV, (Broder's classification) was made (Figs. 1, 2). An *x*-ray of the chest at that time showed a definite shadow indicating a mass in the mediastinum extending to the right into the first interspace and under the first rib anteriorly. A second mass still more definite, rather spherical in outline, was seen in the center of the right lung at the level of the second and

third ribs and third interspace. The diagnosis suggested was, metastatic malignancy (Dietrich).

Fig. 3.

A dental *x*-ray showed numerous apical abscesses in the lower jaw. There was marked irritation of the soft tissues.

*Family History:* The patient was born in Poland and did not know whether his parents were still living. As far as he knew, they had always been well. There were two brothers living and well. The wife was generally well, as were also seven children. Three children had died in infancy.

## EXAMINATION

On examination the patient (Fig. 3) appeared moderately emaciated, weak and apathetic. The skin had a sort of dark hue.

The head presented no gross abnormalities in size and shape. There was no ptosis of the eyelids. The extraocular and intraocular eye movements were normal, as were also the eye grounds. The nose and ears were grossly

Fig. 4.

negative. The lips had good color. Eighteen teeth remained. They were in poor condition with marked caries and pyorrhea. The tongue

Fig. 5.

was diffusely coated and had a yellowish white color. The breath was slightly foul. The throat showed the tonsils removed. The left fossa

was apparently normal. On the right, along the anterior tonsillar pillar and part of the tonsil fossa, a firm mass was seen. There was

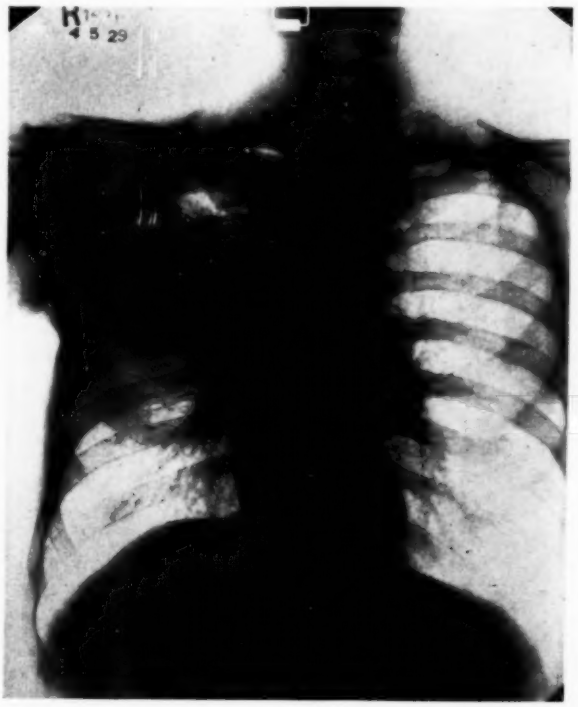

Fig. 6.

no free movement of either the anterior or posterior pillars on the right side. There was apparently no laryngeal involvement.

On the right side of the neck just above the angle of the jaw was a hard, irregular mass quite firmly fixed to the deep structures. The mass measured 8 × 6 cm. in diameter. It was slightly painful to touch and quite red as though inflamed. Over the mass there was a thin scar 3 cm. in length.

The thyroid gland was only palpable.

Chest expansion was only fair and slightly impaired on the right side. Slight palpation of the right chest in the region of the right scapula, chiefly on the inner border, was extremely tender. There were no palpable masses. Tactile fremitus was slightly increased in the region of the extreme tenderness. The breath sounds were vesicular, and there was resonance over both lung areas anteriorly and posteriorly. The apical impulse was not visible. The heart sounds were clear and regular.

The abdominal and rectal examinations were negative. The genitalia were also normal.

The extremities showed marked changes in the form of symmetrical enlargement. The forearms appeared broadened and spade-like. In other words, the diameter of the forearms and wrists seemed almost uniform. By palpa-

Fig. 7.

tion, the bones seemed near the skin. The joints all seemed heavier and broader and the knees, in particular, seemed to have fluid by palpation but there was no definite fluctuation. The movements of the upper extremities were clumsy. Walking was slow and cumbersome, not on account of any loss of control but the members seemed heavy and unwieldy. Muscular strength seemed diminished. There was a normal response to the patellar and Achilles reflexes.

The hands and feet (Figs. 4, 5) were generally enlarged. The ends of the digits were enormously rounded, the transverse and longitudinal diameters of the nails were practically equal presenting the general contour of small watch crystals. There was some dull pain in the extremities, but there was no increase in surface temperature or redness. The biceps and triceps reflexes responded normally.

The temperature was 100°F., pulse 100 and respiration 22. A complete blood count March 13, 1929, was as follows: hemoglobin 70 per cent, red blood cells 3,950,000, white blood cells 11,200. Differential blood count, poly-

morphonuclear 81 per cent, large mononuclear 2 per cent, small mononuclear 15 per cent, transitional 2 per cent. The red cells showed slight pallor and slight variation in size. The blood Wassermann test, as well as the Kahn test were negative. The blood sugar was 118 mg., the blood urea 12 mg., the blood calcium 13 mg., and the blood chlorides 360 mg., all per 100 c.c. of blood. A spinal puncture revealed a pressure of 8 mm. of mercury. The fluid was clear and transparent. The tests for albumin, globulin and sugar were normal. The spinal Wassermann and Kahn tests were negative. Three urinalyses were grossly negative.

An electrocardiographic study showed only an occasional extrasystole.

A roentgenologic study was made of the entire skeleton. Stereoscopic lateral and anterioposterior studies of the skull, March 13, 1929, showed normal outer and inner tables without exaggeration of the vessel or suture markings. The sella showed no thinning of the floor or destruction of the anterior or posterior clinoid processes. There was no evidence of intracranial pathology.

Fig. 8.

Study of the chest (Fig. 6) shows an irregularly circular area of increased density, which nearly surrounded the hilum shadow of the right lung. The border of this density was not well defined and faded off into the lung tissue. It was about 2 × 2 in. in size and extended from the fifth to the seventh ribs posteriorly. The bronchiovesicular markings were not exaggerated on either side. The costophrenic angles were clear and both domes of the diaphragm appeared normal. The heart was of the vertical type and was not enlarged. The diagnosis suggested was metastatic malignancy.

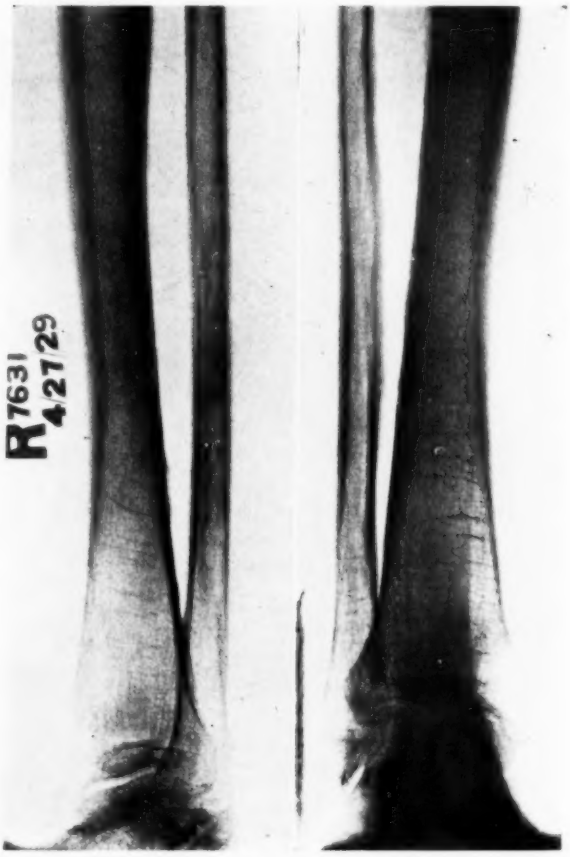


Fig. 9.

Studies of the thoracic spine showed normal contour and alignment of the vertebral bodies without change in the intervertebral spaces. The posterior portion of the fifth rib on the right side showed partial bony destruction involving about three inches from the costovertebral articulation.

Roentgenologic study of the forearms and hands (Figs. 7, 8) in the anterioposterior and lateral views shows a periostitis of the radius, ulna proximal phalanges and the first metacarpals.

Studies of the legs (Fig. 9) shows a periostitis along the tibia and fibula. A periostitis is also seen along the proximal phalanges and the metatarsals.

## CLINICAL COURSE

The patient was treated by deep *x*-ray therapy through the chest, as well as over the growth in the neck. Radium therapy to the growth in the neck was also given. The growth became smaller for a few months but later there was no apparent beneficial response.

The patient soon became progressively worse and was confined to his bed at home. His extremities became so weak that he could not be about. In May, 1929, he noticed that swallowing became more difficult to the extent that in July he could no longer swallow solid food, and by September he could take only liquids.

The cough became progressively severe, so that he coughed day and night. Coughing was associated with a slightly purulent expectoration.

October 9 he was readmitted to the hospital and was in a very emaciated and weak condition. There was a quite constant slight dusky cyanotic hue to the lips and to the finger and toe nails. This became definitely more apparent following one of his coughing spells. His right eye showed considerable bulging. The pupils were irregular, the right being markedly contracted and there was considerable edema of both eyelids of the right eye. The extraocular movements were not limited. The fundus was negative except for mild venous congestion. Saliva was profuse and some easily escaped at the angle of the mouth on the right. There was no drooping of the cheek.

The patient expired October 17, 1929. No post-mortem examination was made because the patient had expressed the desire that his body was not to be cut after death.

## CRITICAL COMMENT

The patient was presented before the hospital staff. Because of the infrequency of this type of disease it was considered worthy to report the case in the literature. The origin of the malignancy is not certain. It may have originated from the right tonsil or from a branchial arch, with multiple metastasis to the lungs and elsewhere, or it may have been primary in the lung with metastasis to the lymphatic glands of the neck.

The recognition of secondary pulmonary osteoarthropathy as a pathological entity, dependent upon disease elsewhere in the body is credited jointly to Bamberger 1889–1891 and Marie 1890. It is generally considered secondary to some obvious primary disease. In all, Locke collected only 5 cases in which the patients were otherwise well, and he concluded that these 5 cases lost much of their significance, because in none of the cases had a post-mortem examination been done.

In 1906 Alexander collected 77 instances of the disease from the literature.

In 1915 Locke made an exhaustive review of the literature and collected 144 cases. He proved quite conclusively that ordinary club-fingers and secondary pulmonary osteoarthropathy are stages of the same disorder.

In 1928 Brooks Palmer Stephens collected 156 cases, adding 5 from the records of the Mayo Clinic. He endeavored to show experimentally that the skeletal changes are not due to a toxin but rather to mechanical blood stasis.

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# UNUSUAL STRANGULATED INDIRECT INGUINAL HERNIA*

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STRANGULATION of an indirect inguinal hernia with intestinal obstruction is a relatively common condition. The loop of gut after entering the sac becomes constricted, edema develops, reduction becomes impossible, obstruction develops and gangrene of the involved intestinal loop follows. The site of constriction is more often found at the external inguinal ring than at the internal ring. In either case the strangulated loop occupies a portion of the sac in the inguinal canal or beyond the external ring. The case herewith reported presents unusual features which are worthy of note.

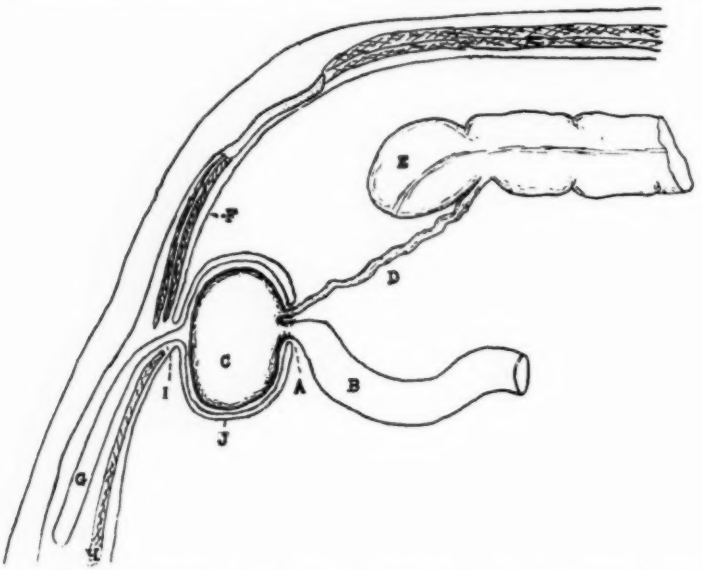


FIG. 1. A. Constricting neck of peritoneal sac. B. Dilated obstructed ileum. C. Strangulated complete loop of ileum. D. Collapsed terminal ileum. E. Cecum. F. Parietal peritoneum. G. Indirect inguinal hernia sac in inguinal canal. H. Posterior wall of inguinal canal. I. Internal ring. J. Double layer of peritoneum making sac which held strangulated loop of intestine.

Mr. A. E. aged thirty-eight, a private chauffeur by occupation, had had a small reducible right inguinal hernia of several years' standing, for which he had worn a truss intermittently. On December 16, 1929 he changed four heavy automobile tires late in the evening. He had no symptoms of any kind until 4:30 A.M. the next morning when he was awakened from a sound sleep by severe abdominal cramps accompanied by nausea. An enema gave no relief and no flatus was expelled. During the day the pain became more severe, recurring every three to five minutes with intervening periods of comfort. Persistent vomiting developed.

When first seen at 8:30 P.M., sixteen hours after the onset of his illness, he appeared to be acutely ill and was vomiting thin watery fluid at frequent intervals. His temperature was 99° F. (mouth), respirations 22, and his pulse 90. Aside from a clean moist tongue the examination of his head, neck and thorax showed nothing noteworthy. His abdomen was slightly rounded and symmetrical with slight muscle spasm and poorly localized tenderness low in the right lower quadrant. There were no palpable masses in the abdomen, inguinal or femoral regions. A digital rectal examination showed no masses or tenderness. On auscultation of his abdomen tumultuous peristaltic sounds were heard coinciding with the attacks of pain and no sounds were heard during the intervals of comfort between the

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pains. A leucocyte count showed 16,200 white cells with 84 per cent polynuclear cells.

Laparotomy for acute intestinal obstruction was performed through a lower right rectus muscle splitting incision. At the right internal ring was found a mass the size of a clenched adult fist extending into the peritoneal cavity. Entering this mass was a loop of moderately distended ileum and leaving it was a completely collapsed terminal segment of ileum (Fig. 1). On dividing the ring of peritoneum (A) an apparently gangrenous loop of intestine 2½ in. long was liberated. The application of hot saline pads to this segment of gut restored the circulation slowly. A purse-string suture of No. 1 chromic catgut was used to close the neck of the sac and no further treatment of the hernia was attempted. The laparotomy wound was closed in layers without drainage. His convalescence was uneventful; the wound healed by primary union and he was discharged from the hospital fifteen days after the operation. Two months later he resumed his usual occupation and repeated examinations have failed to reveal any evidence of a right inguinal hernia. Six months after operation his laparotomy scar was firm and there was no evidence of abnormality in the right inguinal region.

This case is reported to record an unusual type of strangulated indirect inguinal hernia and to again recall the importance of early symptoms, recurring wave-like abdominal cramps, nausea and vomiting, non-passage of feces and flatus, in making a diagnosis of acute intestinal obstruction.

# ISOLATED DIVERTICULUM OF THE JEJUNUM*

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DIVERTICULA may occur in any hollow organ, e.g., bladder, tube or any part of the gastrointestinal tract. They are especially prone to occur in the alimentary canal beginning at the esophagus and in every other section throughout its course, even the appendix.

Previous to the use and interpretation of the opaque medium in roentgen diagnosis, they were discovered only at post mortem or perhaps as a cause of intestinal obstruction. About two-thirds of the reported cases were discovered post mortem. Thanks to the roentgenologist we are now able to recognize them and may plan for their surgical removal, if they cause symptoms.

The literature on this subject is comparatively brief, the greatest number of case reports covering the past five years, although the first was found by Cooper at autopsy in 1844. An outstanding fact of the literature shows the presence of multiple sacculi and they occur late in life. This would support the hypothesis of an acquired lesion.

From a search of available material it seems that the preoperative diagnosis and successful removal of the lesion is not over half a dozen, the first by Case.[1] In all but two in a summary of 33 cases[2] the position was on the mesenteric side of the bowel. In the author's case, in which there was a single diverticulum, the opening was directly opposite the mesenteric attachment. A solitary diverticulum is quite the exception: in nearly every report we have described multiple openings in which the tumor may vary from the size of a pea to that of a walnut. The interest in this subject by *x*-ray workers has shown the comparative high frequency of duodenal diverticula, occupying any place along its course. Diverticula, then, may occur in any portion of the small bowel from the stomach to the colon, the least frequent site being the jejunum. Even when present, multiple tumors (diverticulosis) are the rule.

There can be no proof established as to the cause of this lesion. Those advanced suggest congenital defects: intra-intestinal pressure, traction, atrophy of the muscular coat due to age. These are of academic interest only and of little practical value to the surgeon. The position of the diverticulum on the circumference of the gut may add definite operative problems, e.g., nearly all are on the mesenteric side, that is on the concave side. Any removal, therefore, contemplates the vascular integrity of the bowel. This becomes even more serious when we have inflammation present with edema. In this instance a complete resection of the bowel might offer more promise of recovery than an attempt to remove the tumors individually.

All must feel a sense of obligation and appreciation for the cooperation of the roentgenologists in the matter of diagnosis. In fact a diagnosis would not be possible with any degree of certainty, if based on clinical and other laboratory data. The internist as well as the surgeon must, therefore, look to the *x*-ray department for substantial help in recognizing this rare anomaly. It seems likely that some cases diagnosed as perforating ulcers of the duodenum, not checked by an exploratory examination, may be diverticula.

From the reported cases, confirmed by operation, no fact seems to stand out more clearly than that this lesion does not have a definite symptom complex. In a few cases in which intestinal obstruction was diagnosed the cause was never named previous to operation. This, however, is true: the complaints are of pain in the upper abdominal region, and of long standing.

We wish to report a case of isolated diverticulum, diagnosed as such, operated with relief of symptoms.

* Submitted for publication May 8, 1930.

Case 1. Mrs. M. C. (Lake View Hospital No. 34903, Danville, Ill.) aged forty-two, entered the hospital Jan. 31, 1928, giving a vague history of stomach trouble for the past three years. Chief symptoms of which she complained were distention and cramps in the upper abdomen especially when solid food was taken. There were frequent eructations of gas and often vomiting. This vomitus was never described as acid. If the stomach was not emptied the discomfort often lasted during the night. There was marked constipation.

*Family History:* The only thing of importance was the death of her father at forty-six of some stomach lesion.

*Personal History:* Usual disorders of childhood. Married at seventeen. Never pregnant. Her best weight 130 lb.; present weight, 108 lb. Urine negative. White count 5750.

For about six months before her admission she had been treated for appendicitis, but we could elicit no history of a definite attack. Believing she had this disease she consulted Dr. A. C. Holley of Attica, Ind. and requested an *x*-ray examination.

This was done Jan. 23, with the following findings: Stomach low in abdomen. Found to be one-fourth filled at end of six hours. An opaque shadow, rounded in shape, in the right middle abdomen on level of third lumbar, freely movable and apparently without pain when manipulated. This opaque shadow was present at the end of thirty-six hours after ingestion. A diagnosis of jejunal diverticulum was made.

*Operation:* On Feb. 2 an operation was done. Gall bladder, stomach and pelvic organs apparently normal. The appendix was removed and reported "chronic productive appendicitis." Fifteen inches below the duodenojejunal angle a pouch (single) was found on the convex side of the jejunum, corresponding in size and shape with the film. An opening 1 cm. in diameter communicated with the bowel. The diverticulum was removed.

Dr. E. A. Kraft, pathologist, reported as follows:

*Macroscopic:* The specimen consists of a rather thin, spherical sac with a wide opening at one pole. It measures 1½ in. in diameter and shows intestinal mucosa inside. The latter is somewhat hyperemic and covered with mucus.

*Microscopic:* The sections of the intestinal sac show the usual structures of the jejunum without any special evidence of pathology, except for a moderate circumscribed round cell infiltration within the muscle layers.

Fig. 1. Isolated diverticulum of jejunum.

The surgical recovery was without incident. The patient left the hospital at the end of seventeen days in good condition.

Two months after the operation, Dr. Holley reported that the stomach plane is much higher than in the first picture and is free from barium in six hours. The patient is gaining in strength and weight and is free of symptoms.

### OUTSTANDING FACTS IN THIS CASE

1. Single pouch, removed without intestinal resection.
2. On the free edge of intestine.
3. Thirteen inches below duodenojejunal junction.
4. Recognized as a diverticulum before operation.
5. Removed without intestinal resection.
6. Absence of any other pathology in abdomen.
7. Relief of symptoms, gain in weight.

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# PAIN IN THE TESTICLES

## A SYMPTOM OF RETROPERITONEAL TRAUMATIC RUPTURE OF THE DUODENUM*

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SAN FRANCISCO, CALIF.

THIS case report is of interest not only on account of the location of the lesion but because of the characteristic diagnostic symptoms, which are not mentioned in the literature.

The patient, a twenty-four-year old male, was struck in the upper abdomen by the steering wheel of his automobile when it collided with a telephone pole. He was apparently uninjured, though intoxicated, and walked home from the accident. During the night he was awakened by gripping pains in the upper abdomen and terrific acute pain in both testicles.

Nine hours after the accident he entered the San Francisco Hospital and on examination, there was found extreme rigidity and tenderness of the entire abdomen with the area of greatest tenderness in the epigastrium. Rectal palpation revealed emphysema of the tissues of the pelvis, the crackles being easily elicited. The pulse was of good quality; blood pressure was 90/65; red blood count 4,400,000; hemoglobin 85 per cent; white blood count 4300; with 46 per cent polymorphonuclears, 32 per cent small lymphocytes, and 22 per cent large lymphocytes. A diagnosis was made of traumatic rupture of the bowel, and the patient was taken to the operating room.

A right paramedian incision was made and a considerable quantity of gas or air was found between the transversalis fascia and the peritoneum. Within the peritoneal cavity there was a large quantity of bile-tinged, hemorrhagic exudate, the colon and small bowel were cyanotic, congested and slightly distended. No perforation was found.

The incision was then extended superiorly and the stomach and pancreas found to be uninjured. A discoloration and edema of the peritoneum in the region of the descending and transverse duodenum attracted attention to this structure. When the peritoneum to the right of the descending duodenum was opened, a rent in the posterior wall of the third portion of the duodenum was found. The retroperitoneal tissues were deeply bile-stained, and fat necrosis was present. The wound in the duodenum was repaired and two cigarette drains left in the retroperitoneal region. An enterostomy was then done high in the jejunum. The abdomen was filled with warm saline solution and closed. The patient died the following day.

### CONCLUSIONS

1. The presence of gas or air in the pelvic tissues that can be palpated by rectum is indicative of a retroperitoneal tear in an air or gas containing viscus.

2. When, upon making an abdominal incision, gas or air is found between the peritoneum and transversalis fascia in a patient suffering from an injury a retroperitoneal rupture of a hollow viscus should be suspected.

3. Early excruciating pain in the testicles following a severe trauma to the upper abdomen indicates a retroperitoneal rupture of the duodenum with a spreading out of bile beneath the peritoneum so as to irritate the testicular nerves, the sympathetic chain accompanying the spermatic artery.

* Submitted for publication May 16, 1930.

# OPERATION FOR THE RELIEF OF RECURRENT DISLOCATION OF THE SHOULDER

## WITH PRESENTATION OF PATIENTS*

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NEW YORK

SINCE the operation for the relief of recurrent dislocation of the shoulder was first described in the *Journal of Bone and Joint Surgery*, January, 1929, over 20 cases have been operated upon by various surgeons with uniformly good results.

Most of the cases of recurrent dislocation of the shoulder which we see follow trauma. When the arm is raised from the body beyond a right angle, the greater tuberosity strikes the acromion process. If the hyperabduction is continued, the acromion process acts as fulcrum and the head of the humerus is lifted from its socket, tearing away the capsule of the joint in front and below the glenoid cavity. After once leaving the socket, subsequent movements determine the various positions around the glenoid. Thus we have anterior, posterior, or upward dislocations. The latter is rare and usually associated with fracture of the acromion.

The *pathology* of the recurrent dislocation of the shoulder resolves itself around the various structures which make up the joint, namely, bones, capsule and muscles.

In the bony group, we have many defects in the head of the humerus either acquired after the first dislocation, or due to atropy of the head, infantile paralysis or congenital defects.

In the capsular group, we may have detachment of the capsule from the anterior or the inferior margins of the glenoid. Enlargement of the joint from relaxation following repeated tears.

In the muscular group, we have weakness of the supraspinatus and infraspinatus muscles with contraction of the pectoralis major, teres minor and latissimus dorsi.

From the pathological consideration, we see that in most cases there is usually a combination of two or three of these factors present and to repair only one leaves a loophole for recurrences.

The operation which will now be described is practically the same as the original except for a few additional points.

The incision begins just to the outer side of the coracoid process and passes down along the anterior border of the deltoid for about 4 in. The pectoralis major and the cephalic vein are retracted inward, and the deltoid muscle outward. The tendon of the long head of the biceps is exposed up to its origin. To do this it is necessary to divide the transverse humeral ligament which holds the tendon in the bicipital groove and to split open the capsule in the line of the fibers continuous with the transverse humeral ligament. The tendon of the long head of the biceps is divided 1 in. below the cut margin of the transverse humeral ligament, after placing stay sutures of black silk in the proximal and distal parts, so that the ends may be under control. The elbow is flexed at about 45° during this step of the operation.

A hole is then drilled through the head of the humerus beginning just below the transverse humeral ligament, using a quarter-inch drill. This should be so directed that it comes out at about the center of the articular surface of the head.

A flexible probe is passed through the hole and the arm is rotated out so that it is easier to thread the probe. Next the tendon is pulled through and united with its distal part, using black silk.

The transverse humeral ligament and the capsule are sewed with a continuous No. 1 plain catgut; the skin is also sewed with No. 1 plain catgut.

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The shoulder is put up in a simple Velpeau bandage, reinforced with adhesive plaster, with arm close to the chest and the elbow flexed at 45° and kept up for two weeks.

## CASE REPORTS

Case I. Patient S. C. aged twenty, occupation boxer, gave history of "throwing a punch" while boxing three years ago. This was followed by extreme pain and loss of function of the right shoulder. After some manipulation, he felt something snap back into place in the shoulder. Since then he has felt the shoulder slip in and out of place on the average of five times a week. When first seen he was able to voluntarily dislocate the shoulder and replace it himself.

Patient was admitted to the Hospital for Ruptured and Crippled on March 29, 1928 and operated upon March 20. He had the usual postoperative reactions and was discharged April 6, 1928, six days after operation.

The shoulder was immobilized for two weeks, followed by heat and massage for one week, then manipulation was added. Five weeks after operation the patient had complete function. This patient has been followed up for two years and has had no recurrences.

Case II. Patient E. H. aged twenty-seven, occupation none, due to numerous epileptic fits. The shoulder dislocated on the average of twice weekly during his fits. This has been going on for the last four years and during the last two months it has been getting difficult to reduce the dislocation. The mother brought the patient to the hospital with the hope of reducing the number of epileptic fits as she felt the constant worry of her son about the shoulder dislocations was making his attacks more frequent.

Patient was admitted to the Mountainside Hospital September 8, 1928 and operated on the following day. Discharged from the hospital in ten days. Function was complete in seven weeks. He was free from dislocation until his death in a motor accident January 17, 1930. His mother states that since operation he had had only two fits.

Case III. Patient E. P., aged twenty, occupation student at college. One year ago she fell, fracturing elbow and dislocating the right shoulder. The shoulder dislocation was not discovered until one week after the injury but was easily reduced. When she returned to college after three months she dislocated the shoulder while in the gymnasium. Capsulorrhaphy was performed at a hospital in Philadelphia, June, 1928. This held the head in position for fourteen weeks. The parents took the patient to Berlin where the mother states an extensive muscle operation was performed November 4, 1928. She remained in the hospital for three weeks. Shoulder dislocated two weeks after discharge from the hospital. On May 14, 1929 this operation was performed at the Mountainside Hospital and to date there have been no recurrences. Patient sailed for Europe in February, 1930.

Case IV. Patient G. R., aged twenty-five, occupation salesman. During a friendly exchange of blows, patient threw right shoulder out of joint. For the last two years he has had the shoulder dislocated by simply putting the hand behind the back. When first seen at the clinic the patient had a dislocation of the right shoulder which he could not put back in place. This operation was performed November 5, 1929. Discharged in ten days. Complete function in five weeks.

## SUMMARY

1. The operation is simple to perform.
2. It can be used in all cases, no matter whether the cause be bony, capsular or muscular.
3. There is practically no restriction of motion at the shoulder after the operation.
4. Period of convalescence is short.

## DISCUSSION

Dr. Leo Mayer: I do not think enough can be said in praise of this brilliant and simple operation. We are all delighted with its effectiveness and its simplicity. I want at this time to make a confession. I thought that I had devised an operation superior to Dr. Nicola's. I, too, had had the idea that the biceps tendon could be utilized as a stay ligament. Instead of making a new tunnel for it through the center of the head, I roughened the bicipital groove, replaced the tendon within it and ran a portion of it through a short transverse tunnel. In addition the biceps was reinforced with a strip of fascia lata which ran through the acromian process and a

transverse tunnel through the greater tuberosity. My operation was more complicated and certainly less effective for of the 3 patients in whom I did it, 2 of them had recurrences of the dislocation. I reoperated and did Bankart's operation. This is a difficult procedure necessitating a wide exposure of the joint. Certainly Nicola's operation is far simpler, and in the future it will be my choice in the treatment of recurrent dislocation of the shoulder.

Dr. R. H. Patterson: On two occasions I have used Dr. Nicola's operation and it has been very successful in both instances. One of the cases was a young man of twenty-one, an epileptic, who had dislocated his shoulder twelve times in the year preceding the operation. I operated on August 2, 1929, and it healed very promptly. He has been seen since, and has a normal range of motion. The other case was that of a man thirty-five years of age, a pole climber in the employ of the telephone company. He had had his shoulder dislocated thirteen times in the year previous to the operation; he could dislocate it at will. He, also, was operated on in 1929, and now has a normal range of motion, but he has a limitation of 25 degrees of abduction. The other motions are normal and he is completely satisfied.

The operation is justified on comparative anatomical grounds. Dr. Stockard called my attention to the fact that in the dog the head of the biceps runs through the head of the humerus and he was surprised that the clinicians had not discovered this long before. Dr. Nicola's operation has proved of great use in the hands of my friends in fracture dislocations of the shoulder. The dislocation of the head of the humerus is practically beyond control except by open operation; and if at the time of operation the fracture ends are approximated and reduced, and the long head of the biceps pulled through the humerus, as in Dr. Nicola's operation, you have your fragments in proper position, etc.

Dr. Mather Cleveland: Three or four years ago Dr. Percy Roberts came to the Anatomical Department of Columbia University and I showed him two or three shoulders. He was interested in the subject of habitual dislocation of the shoulder joint. He made a statement at that time that he did not believe one could dislocate the head of the humerus if the transverse humeral ligament was intact and the long head of the biceps was functioning properly. I would like to ask Dr. Nicola and the other surgeons if they have found this transverse humeral ligament had been torn or injured in any way. I can not believe an intact transverse humeral ligament would necessarily prevent a dislocation.

Dr. Nicola (*closing*): Dr. Patterson stated that in 1 of his cases there was some restriction of abduction. This can be obviated by completely abducting arm before sewing up the wound.

As for answering Dr. Cleveland's question, I have not seen any injury to the transverse humeral ligament.

# UNUSUAL TUMOR OF THE NIPPLE*

Ellis Fischel, M.D., and Louis H. Jorstad, M.D.

St. Louis, Mo.

Paget's disease of the nipple and its relation to dyskeratosis in general has recently been discussed by J. Frank Fraser.[1] The pathogenesis of Paget's disease is still a disputed question; however, the work of Fraser and others tends to support the view that the lesion is not a primary one from the skin of the breast, but is a metastasis from duct carcinoma.

In the literature and in standard textbooks on pathology, one finds little reference to tumors of the nipple or even more strictly speaking, changes in the skin of the nipple. Paget's disease is referred to as a specific, chronic, progressive disease, originating in the milk ducts below the nipple, or in the squamous epithelium of the nipple. The typical picture in Paget's disease is that both the epidermis and the milk ducts are affected and one can always

[1] Fraser, J. F. *Arch. Dermat. & Syph.*, 18: 809–25, 1928.

* Submitted for publication May 9, 1930.

find typical swollen, rounded, clear-staining hydropic cells in the epidermis. These are known as Paget's cells.

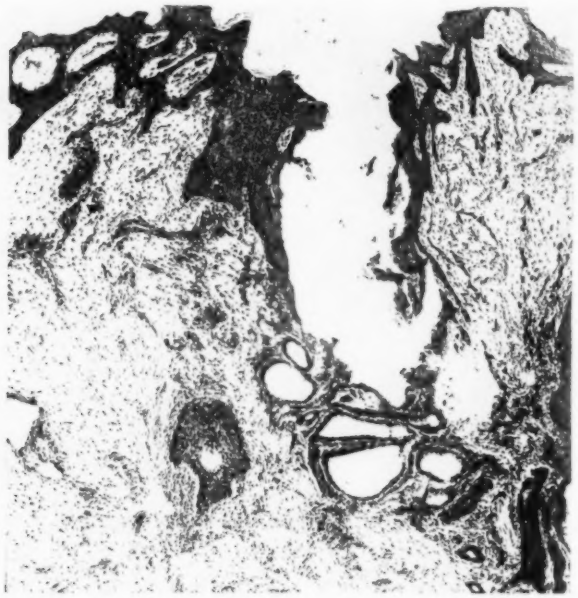

Fig. 1. Low-power photomicrograph of upper portion of nipple from case reported. Cf. Fig. 3.

Fig. 2. Same as Fig. 1, except taken from lower portion of nipple. Cf. Fig. 4.

A case coming to our observation some time ago was that of a married woman twenty-five years of age, who presented the following history:

Seven years ago a verrucous growth appeared on the nipple. This had increased somewhat in size, and it became alternately crusted up to three years ago, at which time the growth was destroyed by desiccation. The resultant wound had never healed. Quite recently she had *x*-ray treatment to the area, without any improvement in the healing. Six months ago, following a normal pregnancy, she nursed her child for a period of two months; then the nipple became so tender that further nursing was unbearable. Upon physical examination at the first visit to our office a few weeks ago, the nipple showed a fissure and in the outer hemisphere there was a definite irritated-appearing reddish growth, measuring $3 \times 2$ mm. in diameter. The nipple itself was indurated, and there was considerable moisture about the growth. Both the mammary glands were somewhat lumpy, yet there were no definite tumors in either. The one with the affected nipple presented no difference to palpation from that of the other. Thus, the anatomical picture was more that of a crusting of the nipple with an inflammation underlying it. The skin of the breast surrounding the area was not thickened, but appeared normal in character and consistency. The nipple and the normal areolar tissue around it were excised. The microscopical findings reveal a lesion which is inflammatory, hyperplastic and keratotic in character. The epithelium is thickened; the keratosis is superficial; there is no edema in the epithelium, neither are there any abnormalities in the cell outline. In that the whole nipple was removed, the ducts can be followed throughout their extent and the epithelium of the ducts, a short distance below the surface, appears normal. Occasionally there is a small amount of inflammation, evidenced by round cell infiltration surrounding the ducts and a desquamation inside of the duct. However, the main lesion is in the epidermis, corium and upper portions of the ducts; the round cell infiltration is most marked in the corium. There is a slight amount of papillation of the epithelium, but there is no definite verrucous formation (Fig. 1).

The interest in this case is whether we are dealing with an early Paget's disease, one earlier than those which have been previously described in the literature, or whether the lesion is that of a keratosis of the skin such as we see in other parts of the body, or whether most of the changes seen at this time are secondary to the previous

treatment for the removal of a verrucous growth.

Histologically, the picture does not fit into the early case of Paget's disease, which has been described in the literature; but we do not have available the breast tissue and thus it will be of interest to follow this case very closely. If a carcinoma of the breast itself occurs within a reasonable period of time, it will be interesting to note the type of this carcinoma, and whether or not it fits into a true Paget's disease of the breast.

Fig. 3. Low-power photomicrograph of upper portion of nipple which appeared grossly normal (described in text). Cf. Fig. 1.

Fig. 4. Same as Fig. 3, except taken from lower portion of nipple. Cf. Fig. 2.

On account of the lack of definite histological study of the nipple of the female breast, we made paraffin sections of a number of nipples which appeared normal grossly. We obtained these from breasts in which the lesion was in the peripheral portion of the glandular tissue so as not to be connected directly with the nipple. We were fortunate in obtaining a nipple from a woman of the same age, whose breast had lactated once, the breast being removed on account of a precancerous cystic mastitis in that portion of the breast tissue which extends toward the axilla. The patient with the nipple in question had nursed one child also. As shown in Figures 3 and 4, the epithelium of this nipple is devoid of hair follicles or sebaceous glands; there is no crusting or keratosis; the corium and subcutaneous tissue are normal; the lactiferous ducts are lined with well demarcated epithelium (best seen in lower edge of Fig. 4), with a small amount of round cell infiltration surrounding them. The relationship of elastic tissue to connective tissue is demonstrated throughout both figures, and the absence of elastic tissue in the major portion of the pathological area in Figures 1 and 2, as compared to this nipple, is definite. The supporting tissue in the abnormal nipple stains more deeply with eosin. The greater amount of glandular tissue, the round cell infiltration, and areas of definite hyperplasia of the lactiferous tubules are the chief differences histologically that the diseased nipple shows from the normal selected.

Sections from nipples removed from breasts of older individuals varying in age from forty to sixty years differ histologically from the normal nipple shown in

Figures 3 and 4 in one particular, only in that the corium and upper stratum of connective tissue contain numerous sebaceous glands. From our study, these are greater in number at the fifty-year than at the forty-year period. The elastic tissue is less and there is more marked round cell infiltration about the lactiferous ducts than in the younger individual. However, the structure of the glandular portion is very similar in all of the grossly normal nipples studied.

### CONCLUSIONS

Photomicrographs of an unusual tumor of the nipple are shown to demonstrate a possible relationship between epithelial changes of a keratosic nature and carcinoma of the glandular epithelium of the nipple.

# EXOPHTHALMIC GOITER IN A CHILD AGED FIVE YEARS*

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ALTHOUGH exophthalmic goiter is seen rather frequently in adults, most authors agree that its appearance before puberty is comparatively rare. Thus in a survey of the literature of the twenty years prior to 1922, Buford[1] found only 18 cases of exophthalmic goiter in children under twelve years of age, and of these 8 were in children under five years. In 1901 Barret[2] collected 39 cases in the literature. Three of these patients were under five years of age, 11 were between five and ten years, and 25 were between ten and fifteen years of age. He estimated that the ratio of children to adults was 1 to 50. Helmholz[3] in 1926 reported 30 cases in children under fourteen years in a series of 3432 patients with exophthalmic goiter at the Mayo Clinic. The youngest in this group was a child three years old, whose symptoms were said to have commenced at eleven months. Lahey's[4] youngest case was also a child of three years. Hertzler[5] operated for exophthalmic goiter in a child three and one half years old.

The impression that unmistakable exophthalmic goiter seldom occurs before puberty is further borne out by the fact that in approximately 1000 cases of this disease submitted to operation at the Long Island College Hospital, the onset was definitely before puberty in only 4 instances, namely, 1 case in which the disease began before five, 1 in which symptoms began at seven, and 2 cases in which symptoms appeared at eleven years. Through the courtesy of Dr. Arthur Goetsch, I am permitted to report the youngest of these cases.

### REPORT OF CASE

D. R., an Italian girl of barely five years, was brought to us first on April 24, 1929. The complaint, obtained from her mother, was nervousness, hyperirritability, fatigue, enlargement of the neck, and protrusion of the eyes.

*Family History:* Her father had died eight months previously of pulmonary tuberculosis. Two maternal aunts were said to have nontoxic goiters, and a cousin died five months after an operation for goiter. Examination of her mother disclosed mild hyperplasia of the thyroid gland.

*Past History:* The child was born three weeks prematurely and at birth weighed 4½ lb. She had severe tonsillitis at the age of two years, which led to the removal of the tonsils and adenoids soon afterward. She also had varicella when two years old and pertussis at the age of three years. Otherwise her health had been good and she had not seemed nervous. Her best weight had been 53 lb. shortly before the onset of the present complaint.

*Present Illness:* Five months previous to

* From the Goiter Clinic of Dr. Emil Goetsch. Submitted for publication August 5, 1930.

April 24, 1929, at the age of four years and nine months, she was frightened very severely. Soon after that she became very irritable and

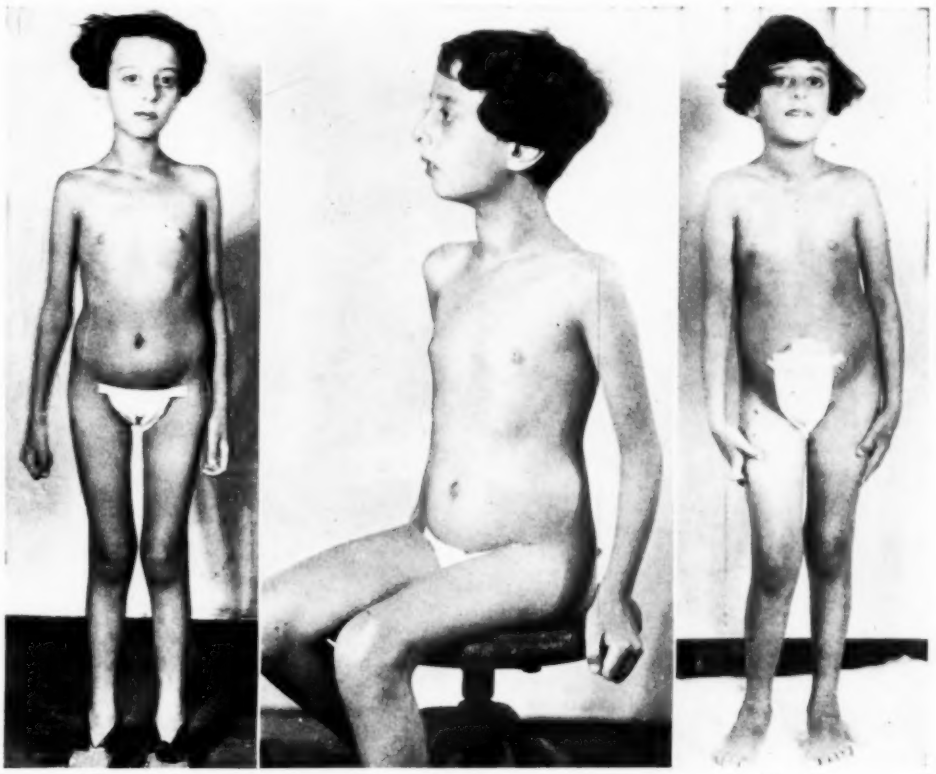

Fig. 1. Fig. 2. Fig. 3.

Fig. 1. Preoperative photograph of the child, five years old, showing marked emaciation and exophthalmos. Blurring is result of her restlessness and inattention. Numerous exposures were necessary to obtain a picture at all satisfactory.

Fig. 2. Lateral view showing thyroid enlargement.

Fig. 3. Six weeks following operation. Note general improvement in nutrition and bearing and decrease in exophthalmos.

developed prominence of the eyes. At that time a physician observed fulness of the neck. She soon became extremely nervous and had a change in disposition, becoming peevish, irritable, and very difficult to manage. She was very restless and seemed unable to concentrate on anything. Her sleep was poor, and interrupted by much tossing about. The exophthalmos and the goiter continued to become more prominent and a marked tremor developed. Her breathing was very rapid and she had mild dyspnea on exertion. The pulse rate was said to have been 165. She had palpitation and some throbbing in the head. Fatigue, flushing and sweating were prominent, and there was desquamation of the skin of the palms at the onset. She had lost 6 lb. in spite of an excessive appetite. During the previous four months she had taken two drops of a brown iodine solution on alternate days, stopping one week before the first visit.

*Physical Examination:* The patient seemed extremely apprehensive, with an expression of anxiety and great excitement. She was very restless and fidgety and was continually moving about in an uneasy manner. The *eyes* showed marked exophthalmos, a staring appearance, brightness of the corneae, extreme widening of the palpebral fissures, lid-lag, weakness on convergence, and dilatation of the pupils. The *mouth* was held open. The facies was distinctly of the adenoid type. The lips were dry and parched. The tongue was red and had prominent papillae. There were remnants of lymphoid tissue in each tonsillar fossa. The *neck* presented a definite uniform enlargement, measuring 27.25 cm. in circumference. Both lobes and isthmus of the thyroid were easily felt, being smooth and firm. There were definite thrills and bruits over both superior poles and over the gland itself. The

*heart* presented heaving pulsations over the precordium. The sounds were forceful and there was a short systolic murmur over the apex. The rate was 140–150, and the rhythm was regular. The blood pressure was 120/40. The nail beds were pink and showed indefinite capillary pulsations. The *skin* was flushed, warm, and showed pronounced dermographism. There were beads of perspiration on the neck, and the palms were wet. The extended fingers presented a marked fine tremor, and the knee jerks were hyperactive.

*Laboratory Findings:* Red blood corpuscles, normal; W. B. C., 12,000; polymorphonuclears 65 per cent; lymphocytes 35 per cent. Urine normal.

*Diagnosis:* Exophthalmic goiter with marked hyperthyroidism. Iodine exacerbation.

*Treatment:* She was urged to rest, although not confined to bed, and was given mild sedatives, such as amytal and quinine hydrobromide. During the next three months there was a gradual improvement in the nervousness and fatigue and, to a slight degree, in the tachycardia. She was then given Lugol's solution, 5 drops three times a day for ten days. This caused a great improvement in all of the symptoms and a decrease of the heart rate to 100. The thyroid gland showed the usual prominence and firmness that follows administration of iodine but not in so striking a manner as that following an initial intensive course of this drug. On August 5, 1929, a double resection was performed by Dr. Arthur Goetsch, a total of 13 gm. of tissue being removed. This was accomplished without difficulty and, excepting for a brisk reaction on the following day, the postoperative course was uneventful. At operation the gland seemed to be about 50 per cent larger than normal.

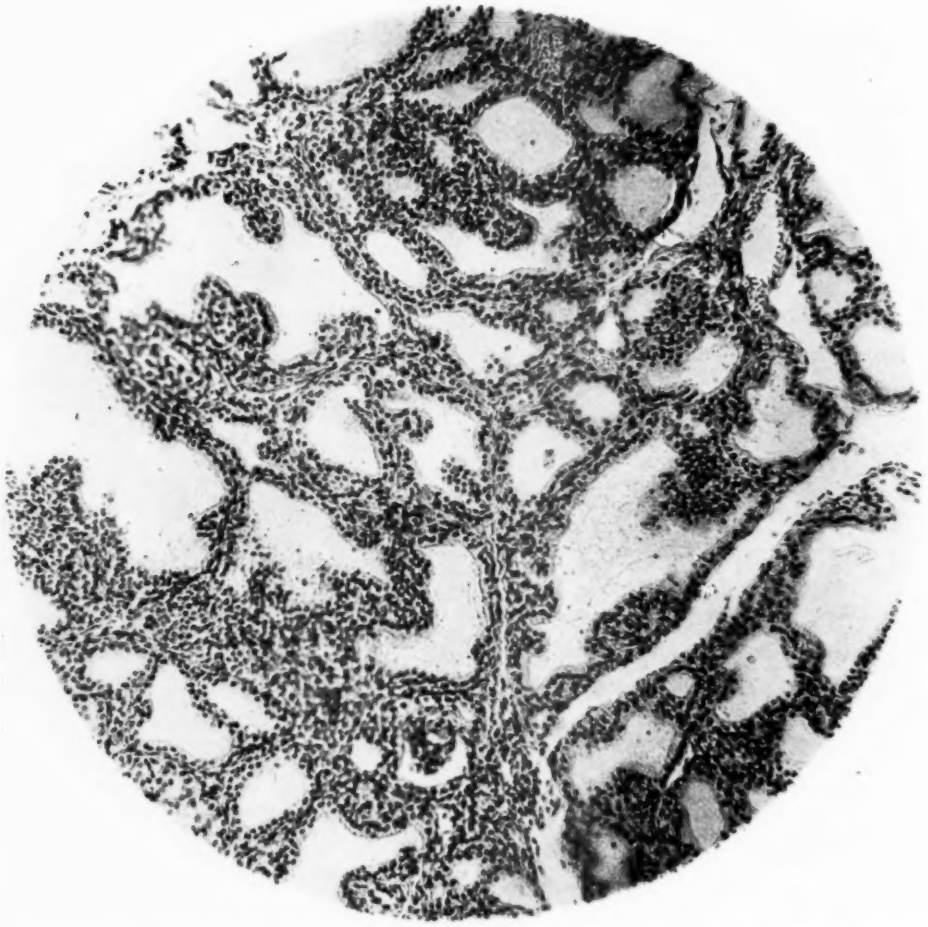

FIG. 4. Photomicrograph of excised tissue. Note failure of involution and rather marked hyperplasia which persisted in spite of intensive iodine treatment. A single adequate course of iodine would have been more effective and have caused this condition to revert to the colloid, or "resting" stage.

In spite of the iodine it showed great activity, as evidenced by its "beefy" appearance and the vascularity. The left lobe contained more colloid and was less vascular than the right.

*Pathological Examination:* Microscopic study showed the characteristic hyperplasia of exophthalmic goiter although there was a moderate increase in the colloid which stained pale pink. The acini were large and irregular in outline because of the polypoid infoldings. The lining cells were tall, columnar, and had deep staining nuclei. There was a moderate increase in the stroma, but very little lymphoid tissue was present.

*Subsequent Course:* Before she left the hospital the nervousness, emotionalism and irritability had diminished to such an extent that she was not unlike other children in her behavior. The pulse stabilized itself at 90–100. Ten months after the operation, she shows great general improvement. There is no tremor and practically no nervousness, but a moderate exophthalmos persists. She weighs 61 lb., which represents a gain of 14 lb. since the operation. Her pulse rate is 90. The neck is normal in size and appearance and there are no thrills or bruits.

## COMMENT

Apparently the severe fright which this child experienced was sufficient psychic trauma to precipitate the disease. On the other hand, the death of her father is said to have caused no emotional effect. The presence of goiter in several members of her mother's family is significant. Others have emphasized hereditary tendencies in similar cases. The history of previous tonsillitis is interesting in view of the well recognized lymphoid hyperplasia that occurs in exophthalmic goiter.

This case illustrates the very bad effects of long-continued administration of iodine in hyperthyroidism. It should be appreciated that iodine is very valuable in the preoperative preparation of the patient with exophthalmic goiter, and when so used it should be given intensively, and should not be continued longer than two to three weeks. When given intermittently, or continuously for several weeks or longer, the symptoms become markedly aggravated and the patient who might ordinarily stand a major procedure without great danger is converted into a serious operative risk. In fact, operation must frequently be deferred until the system has had time to eliminate the iodine. Thus in the foregoing case the child when first seen by us was in a state of marked iodine exacerbation. It was necessary to wait approximately four months to permit the elimination of the iodine from the thyroid and thus render the gland once more capable of responding favorably to a brief period of intensive iodine administration. Unfortunately, subsequent courses of iodine are not as effective as the primary one. Our case confirms this fact very strikingly both clinically and pathologically. The gland showed only a moderate increase in colloid and, notwithstanding the intensive iodine treatment, it still presented considerable hyperplasia. It is deplorable that so many physicians persist in treating all types of goiter with iodine.

Although only moderate benefits were derived from general medical and sedative treatment, a rather striking improvement has followed bilateral resection. We realize that this patient cannot as yet be discharged as permanently cured, hence we plan to observe her at regular intervals until after puberty to note any signs of recurring hyperthyroidism. It is well known that even in adults, remnants from subtotal resection in Graves' disease occasionally hyperplase and cause recurrence of symptoms. It would seem that the tendency to hyperplasia might be still greater in the growing child.

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# The American Journal of Surgery

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**The American Journal of Surgery is truly independent and enters into no "entangling alliances." It publishes many papers read before the leading surgical societies of the Country, but it is *not* "the official organ" of any organization. Every manuscript is selected by the editors, as worthy of publication—nothing is published merely because "it was read at the meeting."**

# EDITORIALS

## NOTES AND COMMENT

WE look toward the future with optimism, curiosity and hope. These are but human traits. In going through lay magazines we are struck with the editorial announcements that next month there will be offered the greatest feature article, the most perfect story, the biggest, greatest, etc., number ever offered. The future always has the best in store. Superlatives deal with tomorrow.

And so, should we be satisfied to hit the conventional note we would ignore what has passed and turn to the months ahead. Before we finish we will deal with 1931. However, we pause and dwell with 1930, just gone into history.

It was twelve months ago that publisher and editor decided to double the size of THE AMERICAN JOURNAL OF SURGERY. We were forced to make this move. Three years ago when we became editor we lost sleep wondering how we would fill one hundred pages of reading matter each month. We implored our friends to get busy and produce articles; we wrote begging letters by the score. Often we were discouraged. Things just did not seem to click. Then, imperceptibly at first, material began to arrive daily. We soon realized we had accepted more than we could handle. We felt that an article, once accepted, should receive fairly early publication. It was a wrong system that allowed a paper read on January 1, 1930, to be published in the January, 1931, issue of a journal. We began to receive letters pointedly asking "when will my article be published?" We began to lose sleep on account of a plethora of material. There was only one solution to the problem. Enlarge the journal. We doubled the size.

We increased the reading matter from

100 to 200 pages. In fact we had been publishing about 140 pages monthly and during the past year have gone far in excess of our 200 pages a month allotment.

Some of our friends asked if it would not have been easier to have rejected most of the material offered and kept to the smaller size. This brings up a debatable subject. When we inquired what type of article we should exclude the answer usually was "all except the most interesting." "Interesting" articles were usually what that individual specialized in. But if one published nothing but gynecological or urological or neurological articles it would become a class journal and of interest only to a selected few.

The increase in size offered greater opportunities for a wider range of material. In each issue there was sure to be something of interest to everyone. That we were on the right track has been proved by the steadily increasing circulation. To-day The American Journal of Surgery has the second largest paid circulation of any surgical journal in the country, probably in the world.

And so we have tried to interest the majority. We have attempted to offer articles that have a decided practical slant. No one reads the journal from cover to cover each month. But if each month a reader finds some things worth while and of value to him, things he can use in his everyday work, then an ideal state has been approached. One reader will be bored by an article for which any editor would give his celestial right hand. However, the same reader will discover an important point in a modest, almost commonplace case report.

And while we are rambling on in this personal style let us answer at this time many points made by those with whom we come in personal contact and by those with whom we have corresponded. Many ask why we do not publish *only* articles by nationally known workers. Names! Perhaps such a policy might be good "box-office" tactics for lay publications, but science is a temple with many open doors and anyone may enter provided that he will knock and can deliver the goods. As a rule the man with an established reputation can be depended upon to score but it is also true that he is human and, at times, capable of offering a rehash of a subject done to death. Thus we have published the effort of many *as yet* unknown surgeons. We accepted their offerings because they had something to say that was worth while.

Before we finally reach what we started out to say perhaps it may be well to explain certain things. We have been asked why we no longer are the official organ for societies, etc. This was a deliberate move on our part. Every so often there arrived a large package of manuscripts. They were the transactions of the "last meeting." An article or two would be above par. The rest were just "those things." Knowing how programs are arranged we could hear a president or chairman say, "Dr. Blank is coming on from New Orleans or Chicago or Baltimore to read a paper. I want you to read a short paper as a curtain riser. Something not too long. Have a few lantern slides. I'm getting a couple of the boys to present case reports. Of course you can do it. Do the thing you gave last year. A short paper by you and a couple of case reports will round out the program." It became embarrassing to have to spot these fillers only to have to return them. It caused "hard feelings." It led to correspondence. We had to be diplomatic. We wished we could bluntly say the stuff was terrible and let it go at that. It reacted on our nervous system.

And then we found out another amazing fact. There *are* cliques! Play with one clique and the other clique will have nothing to do with you. Politics! Letters! Explanations! Wheels within wheels. Overboard with all of it!

So with no regrets, we decided to be independent! Just because a thing was read "at the last meeting" meant nothing to us.

We had other criteria: was it good, interesting, authentic; did it teach something or emphasize an important point?

We started this to mull over the journal during 1930. We have wandered so far afield we will have to leave much of what we were going to say to another time. However, we look back with real pride to Edward M. Livingston's serial, "A Clinical Study of the Abdominal Cavity and Peritoneum." We read the manuscript a year ago last August at the seaside. Sitting tailor fashion on the sand under a gay umbrella we found we were reading it as we would have read an interesting work dealing with history or biography. The writing flowed. We did not have to command the mind to plug through it. We knew we had something solid to offer our readers. As a reward some of the most famous American surgeons have said that it is a real contribution to surgical literature. It is sure to live and find a permanent place among surgical publications. In the spring it will be brought out in book form. To the twelve installments will be added a few additional chapters we did not have the space to include. In every sense the book offered will be a second edition. It will be a book necessary to the medical student and invaluable to the practicing surgeon. We congratulate Livingston on a splendid piece of work.

We would like to tell of other high spots of 1930. We were the first in this country to publish the new method in intravenous pyelography . . . an article on Uroselectan by Swick. Last month Dr. Case reviewed the articles on Radiology appearing in 1930 in The American Journal of Surgery, so we will not duplicate his work, but will simply state that many excellent articles are scheduled to appear in 1931.

Another book will be offered our readers in serial form during the year. We read the manuscript and knew before we had gone far that we had a valuable monograph. We wired the publisher, then in the West, to arrange for its publication. It was new, different, practical, sound, well written. We refer to Dr. Cutting's "Principles of Preoperative and Post-Operative Treatment." In this issue appears the first installment of this work. We urge every reader to follow it carefully. We believe a modern surgical journal should offer something throughout the year in a truly educational, almost textbook manner, in addition to the usual shorter articles, and in fulfilling this aim we consider ourselves and our readers fortunate in having Dr. Cutting's book as a part of the journal.

The material on hand is of an exceptionally high grade. 1931 is destined to be far above the average. We are open to suggestions. We welcome them. We want a journal that is read and found valuable by all surgeons.

We wish to take this opportunity to express our appreciation and sincere thanks to the many who have aided us in the past. Without them and their earnest help and practical suggestions we could not have carried on.

We wish to you, one and all, a Happy, Healthy and Prosperous 1931. T. S. W.

# THE ROENTGENOLOGIC VISIBILITY OF THE NORMAL GALL BLADDER

THE demonstration in the roentgenogram of the actual outline of the gall bladder shadow was first called to the attention of radiologists in cases where gallstones were clearly delineated. A number of American authors, especially A. W. George, attributed considerable importance to these faint ovoid or globular shadows in the right upper quadrant which corresponded in size, shape and position to the gall bladder, especially because in several operative cases where a large

hydrops of the gall bladder had been found, re-examination of the *x*-ray films showed what seemed to be the clear outline of the enlarged gall bladder, which because of its size had been mistaken for the kidney. It, therefore, appealed to Dr. George and others that under certain conditions the gall bladder itself was visible, and they soon observed that in cases coming to operation where the gall bladder had been outlined on the film some sort of pathology was invariably found in the gall bladder itself. Dr. George argued that with the present technique the gall bladder shadow might be produced on the *x*-ray film, if some change from the normal had altered its density, and he finally reached the definite conclusion that if the shadow of the gall bladder was seen on the *x*-ray film, it was an indication that the gall bladder was pathological. It is significant that Dr. George stated in 1922, "doubtless the time will come when with improved technique one will be enabled to visualize a normal gall bladder," thus foretelling the discovery made by Graham and his colleagues in 1924.

However, there were many who did not agree with Dr. George in his conclusion that the gall bladder when visualized in the *x*-ray film was always pathological. In the first place, it should be noted that cases come to surgery, not only and not chiefly because of the *x*-ray evidence, but because of pathological manifestations giving rise to subjective and objective findings which really confirm the surgeon in his decision to operate. We, therefore, believe a considerable factor of error enters into the apparent statistical confirmation of the cases referred by Dr. George; in other words, a certain number of pathological gall bladders were operated upon, and, because in a number of them the apparent outline of the gall bladder was distinguished, the conclusion was reached that to see the outline of the gall bladder on the film meant that the gall bladder was pathological.

Of course, the introduction of Graham's method has permitted us to check on these shadows. Very often we have been surprised to find that the apparent gall bladder shadow must have been due to something else, because the gall bladder as visualized by Graham's method did not coincide with the suspected shadow. The writer of this editorial suggested[1] that many of these shadows which were at first thought to be gall bladder shadows were later proved to be due to something else. Some of them were due to the duodenum seen in profile; others to one of the lobes of the liver which are sometimes present, having more or less the size and shape of the gall bladder.

This subject was recently discussed before the Société de Radiologie Médicale de France.[2] Dr. Ledoux-Lebard, in charge of the course of radiology, University of Paris, said that up to the present time it had been generally considered that the fact of visualizing the gall bladder on films made without previous preparation of the patient warranted a strong assumption in favor of the existence of a pathological state of the walls of this organ or a modification of its contents. Ledoux-Lebard now thinks that the moment has arrived to criticize and revise this opinion in view of the enormous progress in technique realized in the last five years.

Under modern technical conditions it is justified to believe that a mass of liquid, amounting to 20, 30 or 40 c.c., such as is generally represented by the normal gall bladder full of bile, is more than sufficient to cast a shadow recognizable in good roentgenograms of patients of average weight or less. Multiple control operations carried out by the surgical service of Professor Gosset have confirmed this opinion, and Ledoux-Lebard now believes it is important to warn radiologists against interpretations which subject them to such great risk of being inexact.

[1] Case, J. T. Some pseudovesicular shadows and other pitfalls in gall bladder roentgenology. *Radiol.*, 2: 1, 1924.

[2] Ledoux-Lebard, M. R. La Visibilite de la vesicule biliare normal. *Bull. et mém. Soc. de radiol. méd. de France*, 170: 243, 1930.

The writer of this editorial in 1927 suggested that the ovoid pseudovesicular shadow so often seen in the right upper quadrant may be due in most instances to the shadow of the duodenal bulb and the upper portion of the second part of the duodenum itself, where it passes posteriorly to make the beginning of the duodenal curve. The average roentgenogram of the abdominal region shows the psoas muscles and even the lumbar muscles, and a number of other soft tissue outlines which can be delineated on a well exposed film. It is reasonable to suppose that at times we may see a rounded shadow just below the inferior border of the liver, due to the piled up density of a segment of the duodenum recorded in profile. This opinion is sanctioned by the fact that very often we see within this ovoid shadow a bolus of gas, representing gas within the duodenum. The pyloric end of the stomach may cause a pseudovesicular shadow, although it is larger than one would expect for the outline of the gall bladder. As already mentioned a shadow simulating that of the gall bladder may be caused by one of the lobes of the liver.

With rare exceptions the writer deems it impossible to identify with surety any right upper quadrant rounded or ovoid shadow as due to the gall bladder until the gall bladder has been visualized by the injection or ingestion of dye by the Graham-Cole method. In the direct examination of the gall bladder without the aid of cholecystography, a small rounded shadow in the right upper quadrant, distinctly not caused by the inferior border of the liver or by the kidney, is in all probability due to something else than the gall bladder. James T. Case.

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JAKOB BENIGNUS WINSLOW

[1669-1760]

# "FORAMEN OF WINSLOW"

JAKOB BENIGNUS WINSLOW was born at Odeuse, Denmark, April 2, 1669. His father and grandfather were Lutheran ministers. Thus, it was natural that Winslow should study for the ministry. But he turned from this and began his medical studies. In 1697 he engaged in pre-medical study in Holland. A year later he continued his studies in Paris and became a student of the French anatomist Duverney, who encouraged him to direct his work especially toward anatomy. In 1702 he matriculated in the University of Paris, from which he received his degree, Doctor of Medicine, in 1705. Two years later he was presented to the Royal Academy of Sciences by Duverney. So great was Winslow's ability and so deep was Duverney's faith in this ability that he often allowed Winslow to conduct lectures on Anatomy and Surgery at the Jardin du Roi. After Duverney died the chair at the Royal Garden was filled by Hunault. Later Winslow occupied it for many years.

When Winslow began to study medicine he spent his unoccupied time with theological problems and went deep into the study of philosophy. Whether as a result he turned Catholic we cannot venture. But he did accept the Catholic faith and as a result was disinherited by his family.

When he began the study of medicine he was granted a pension by the Government of Denmark, in order "that the country might not be without participation in the glory of advancing the progress of anatomical knowledge." At a later date the Bishop of Meaux gave him financial aid. The Bishop died one year prior to Winslow's graduation so he sought the faculty of the University of Paris for financial assistance, which faculty "was not deaf to his pleas but even paid all his expenses for the rest of his course."

Winslow is credited as having been the first to use the term omentum in its present sense. To the casual student the original words of Winslow are hard to comprehend. This is because he used the term "lesser omentum" in a different sense from what is used at the present time. Winslow's "lesser omentum" is the lesser peritoneal cavity of the present day.

The source of the eponym, "Foramen of Winslow" is in "Exposition anatomique de la structure du corps humain," Paris, 1732, 2:170, 352–365.

Winslow demonstrated the communications of the foramen, now bearing his name, by inserting a quill or pipe into this opening, and then blowing air through the quill. He discovered the air distended the greater omentum.

Winslow published several books and papers between the years 1711 and 1742. Other eponyms bear his name: Winslow's ligament and Winslow's stars. He did much to systematize the anatomical knowledge of his day.

He lived to the old age of ninety-one years, departing this life on April 3, 1760.

T. S. W.

[From Fernelius' Universa Medicina, Geneva, 1679.]

# BOOKSHELF BROWSING

## SCIENCE AND CONSCIENCE IN SURGERY*

M. Le Professeur J. L. Faure

PARIS, FRANCE

THE *Revue de Chirurgie*† presented to its readers the speech *in extenso* given by Professor J. L. Faure on "Science and Conscience in Surgery" at the inauguration of the *Medical Journals of Brussels* (June 28, 1930), in the presence of Their Majesties, the King and Queen of the Belgians. Permission was granted by the Publishers of the *Revue de Chirurgie* to The American Journal of Surgery for American publication.

Sire, Madame;

May I be permitted to greet you both with the homage which is due you.

For you, both of you, are the living symbol of those great memories of grief and glory which will never be effaced from the history of the Belgian people.

You, Sire, were the Man of Destiny. For it was you, it was you alone, who, in the sublime moment when you drew the Sword of Justice, changed the course of history. For it was you, you alone, who, by delaying for a few days the profane invasion, allowed the great soldiers of Joffre to draw themselves up on the Marne and to win the immortal battle.

And the sons of France will never forget that it is to you that they owe the fact that they still have a country.

And you, Madame, beside your King "sans peur et sans reproche," knew how to be a Queen! You knew, in the most tragic hours of history, how to raise yourself as high as he, by your courage as well as by your devotion.

After trials without number you came back together, among the flags waving in the breeze of deliverance, to your cities transformed by the colors of the fatherland. United in the memory of men as you were in life, you will remain forever the King and Queen of Victory!

Your Excellencies, ladies and gentlemen:

One of the great emotions of my life, and perhaps its greatest honor, will be to have been chosen twice to speak under such solemn circumstances. Ten years ago these Journals were being born, still uncertain of the future and of the great fortune which they were going to find. Today, after ten years of uninterrupted success, doctors from all over the world have come to give them a universal consecration.

Ten years have passed, pushing little by little into the shade, still crossed by sparks of sad memory, everything which at that time was moving our broken hearts,

†The translation is by Grosvenor Wainwright, of Scranton, Pa. Ed.

* Submitted for publication November 20, 1930.

when we were just emerging from the greatest drama of history.

And here we are met again, we who come from France, in the happiness of seeing, as in a sort of spiritual renaissance and youthful joy, noble and fraternal Belgium, she who was side by side with us in martyrdom and in glory, celebrate enthusiastically the youth of her one hundred years of age.

No one can be astonished if on a day like this a surgeon should find it natural to speak of surgery.

For half a century, since it lost that gravity which formerly surrounded it with an atmosphere of grief, it is today a part of our life. There is no family which has not seen it enter the home, and the hecatomb of the Great War did more for the diffusion of its benefits than one hundred years of peace.

But although it was given to millions of soldiers and thousands of nurses to witness its powers, very rare indeed are those who are able to seize the profound impressions and moral discipline which make of this magnificent and at the same time terrible art the one which most of all subjects to the hardest trials the hearts of men who consecrate their lives to it.

At any instant in our vocation and in our assiduous labors the obscure forces which shape our destiny may place upon us heartbreaking problems, perhaps even the redoubtable task of deciding at any minute upon the life and death of those whom chance has placed in our hands.

Without doubt there is in the souls of all men a force of habit, a power of adaptation to circumstances, when these circumstances are met every day, which bring it about that our impressions are attenuated and most of our daily decisions do not move us, as they should do, to the deepest fibers of our hearts.

When, followed by our pupils, we pass slowly before the beds of our patients, we seem no longer to realize the formidable power which we hold in our hands, and when we pronounce in a voice which no emotion has altered the few words, cutting as the scythe, which decide an operation, we know nevertheless that these few words, falling in silence like the sentence of a judge, can precipitate a living being into death and irrevocably throw a human existence into the scales of destiny.

What power indeed! What almighty power! And what, compared to ours, is the judgment of men?

Under the majestic vaults. of the tribunes and the courtrooms, in the red of purple robes and the white of ermine, in the pentup anguish of the crowd is meted out the justice of men!

In the bare halls of our hospitals, among the beds where lie, silent and resigned, so many victims of human misery, a few words falling from our lips will decide their fate, without appeal and without remission, like the justice of God!

May the force of habit not blind us to the grandeur of our mission! It is our duty to be conscious of it and to reflect deeply on the responsbility which is imposed upon us by a power without limits!

We have not the right to undertake lightheartedly the practice of this beneficent and redoubtable surgery if we do not feel strong enough to master it before taking the responsibility of those irreparable acts, surgical operations. For there is not one of them which does not carry with it the possibility of death. And he who puts his confidence in us and abandons himself to our hands is like the traveller lost in a storm, under a sky afire with lightning, and thunder over his head.

Surgery is then full of grave responsibilities which we cannot support without having done all that is necessary to fit us to perform them well.

And they are long studies! Anatomy first, anatomy which many seem to scorn, but which alone can give to him who knows it well that assurance indispensible to every surgeon worthy of the name, who knows what he is doing, who knows where he is going, and who works with that profound sense of security which can come

only from a faultless knowledge of all the secrets of the human body.

After anatomy what is necessary to know above everything else is the science of diagnosis. For this, all that one can read in books hardly counts compared with experience. What counts above all is the personal inspiration and instinctive impressions which proceed from an artistic sense much more than from the rigid laws of a determined science.

Let us seek constantly, let us seek carefully for that sovereign quality in the surgeon, operative science. For it is to this, to its application in certain dreadful and often tragic hours, that our art owes its most glorious triumphs. Everything converges, everything ought to converge, on operative procedure. In the end what avail the compilations in books and the lessons in amphitheaters, on the day when it is necessary to take the responsibility of a difficult operation? It is at the operating table that one learns the art of operating. It is in working next to a master, in assisting him in his interventions, in participating with him in his delicate maneuvers, which are well seen only from near by, in coordinating one's movements with the master's deft touch, that it is possible to intiate oneself little by little in the ever-new difficulties of an operation and to feel one day the right to undertake such an operation on one's own responsibility.

It is here, it is in the art of operating, that enter above everything else the personal qualities of the surgeon. For it is not sufficient to have aided a master for several years, to have seen, to have worked, to have reflected; it is not sufficient finally to know; it is necessary rather to acquire, if a generous nature has not accorded it, that ensemble of qualities which constitute the operative art, made up of method, of reason, and of good sense, much more than of cleverness. It is these qualities which constitute the personal mark of each operator and which bring it about that between two surgeons who cure their patients equally well there can be as much difference as there is between a great and inspired artist and one whose chisel, even if faultless, will never be able to make the spirit of life glow in the whiteness of inanimate marble.

And finally there is something which dominates all. There is something which in the effort of a magnificent inspiration has made the operator evolve from his very soul some new means of marshalling the forces of life against the powers of death. Here is not only the good workman who disappears when his task is ended. Here is not only the perfect artist whose gesture vanishes to leave only a memory. Here is the master whose enduring work will defy the havoc of time!

If the masters, if the surgeons whose names are known to all, draw to the amphitheaters and to the operating rooms students, disciples, other surgeons, from the most diverse and remote countries, in order to hear their teachings and to see the work of their hands, still these masters cannot do all. It is requisite, it is necessary that the innumerable operations which are performed every day be entrusted to a sufficient number of surgeons. But it is also necessary that these surgeons be capable of undertaking them and worthy of the confidence which one is obliged to place in them.

And here lies the great problem at the present moment, with the masters, with the surgeons qualified by their work or by the choice of their peers, during a lifetime of difficult tests where sometimes legitimate hopes are dashed, work, students, internes, assistants, who absorb from their masters the necessary discipline after years of hard work.

Indeed I am not one of those who think that one can not find valuable men outside those who are consecrated officially by examinations and competitions! No! Talent is a marvellous flower which can blossom freely in the disorder of the forest as well as in the severe ordering of a park. But talent is rare and the practice of surgery

claims innumerable resources in men from whom one can ask neither genius nor talent, which are the privileges of a few. But from these men one has the right to demand an exact science, a sufficient experience, and that probity of mind necessary to the practice of an art which confers superhuman rights.

This is a grave question, and one which preoccupies many minds. The relative harmlessness of surgery, and also the implacable necessity of its diffusion during the War, have put it into the hands of a great number of men, and today every doctor, armed with his diploma, which confers on him every right, can, without ever having held a bistoury, open a clinic and make himself a improvised surgeon on occasion.

If I say this here, it is because it happens not only in France, and because these things must be known and known by all, for everyone some day or other may have need of this surgery which may be useful or harmful, fatal or beneficent, according to the man who practices it. A certain number of surgeons, disturbed by this situation, have believed it their duty to bring it before the Academy of Medicine and ask that the habitual practice of surgery be not authorized unless, aside from the present diploma, the future surgeon possess a certificate of competence in surgery, delivered for example to all those who beside their higher examinations, shall have successfully passed three years in a surgical service.

Troubles of the same kind, if I am not mistaken, have appeared in the Royal Academy of Belgium.

This reasonable and moderate demand has been rejected by the Academy of Medicine which satisfied itself with accepting an optional certificate, changing nothing in the present state of affairs. The Academy, I am not afraid to say, has given in this case a very poor idea of its sense of responsibilities. It did not wish to diminish the value of a diploma created more than a century ago, at a time when surgery, or at least surgery such as we understand it today, did not exist, so to speak. It confined itself to some few urgent interventions, which no longer count, when by thousands and thousands and tens of thousands, in a single country like France, countless patients come every year under the surgeon's knife. How many in that immense crowd are led by the blind chances of fate into the hands of a man of great experience, or into the hands of a beginner who knows little or nothing?

For the diploma in which they wish to place confidence includes nothing of surgery. It is worth exactly what the man who owns it is worth, and everyone knows that, by the force of things, every student gets it either by a happy chance or, still more often, by the laziness of the judges and by an excessive good nature.

Without doubt it is easy to say as they did at the Academy that they have not the right to deprive a doctor, armed with his diploma, of the power of practicing surgery when so many of them do it admirably. It is easy to show that frequently they have not only the right, but are duty-bound to do it, and there is no doctor out in the country who does not have a precise moral obligation to give his best assistance, by whatever means at hand, to an injured person whom he finds bleeding on the side of the road, an occurrence not rare today, when the folly of speed hurls to death so many voluntary victims. And how many other urgent cases there are, such as a violent hemorrhage, a strangulated hernia, a complicated fracture! Truly, we can never say enough good of these country doctors, who do honor to our profession, who labor day and night, in the burning sun of summer and in the snows of winter, who are sometimes the safeguard of an entire countryside, caring for children and old people, women in childbirth, and all those hurt in life. At the end of a career of fatigue and devotion they die in poverty, leaving to their sons only the honor of their name and the greatness of their example, while the bartender at

the corner by poisoning his fellowmen behind his bar gains the wherewithal to dower his daughters and retires on his savings.

It is no less certain that today when surgery, to be well done must be practiced in a place especially organized for the purpose, with facilities of transportation; such as the automobile, with clinics, which are spreading everywhere and are almost always directed by good men such as the former internes of our hospitals; it is no less certain, I repeat, that it is to these clinics that the immense majority of patients amenable to surgery must be directed. We must leave only the cases incapable of transportation and those too urgent to await the arrival of a surgeon to the country doctors, whatever their science and their knowledge, often deep, of all the branches of medicine may be.

These few reservations being made, it is permissible to find it deplorable, not to say senseless, that the lives of citizens be entrusted, in the name of the law, by virtue of the sovereign rights bestowed by his diploma, to a young man. Likewise it is senseless that a beginner, recently fortified by his thesis and never having opened a Whitlow, should serve his apprenticeship in surgery on his fellowmen. Who would be astonished that under these circumstances one at times sees certain bad practices? These would not be slow to disappear if the practice of surgery were confined to men capable of exercising it with all their science and all their experience.

For science is not enough. It is only a powerful arm, which can become disastrous if not directed by a more powerful force which rises from the depths of our souls and is called conscience.

It is in fact our conscience alone which must inspire us in that fleeting instant when we take the step from which there is no appeal, to play the supreme part on which a human life depends. And it is again our conscience alone which upholds us in the dizziness of the action which at times seizes us, lifting us above ourselves in the magnificient exaltation of certain operations in the course of which, like the eagle of the high peaks, we feel ourselves rise toward the summits of art!

The habit of playing each day with the lives of men must not make us lose sight of the tremendous power with which we are armed, and which has no equal in this world, except that of a military commander, whose order in the drama of battle may send thousands of soldiers to death or to victory. We ourselves have responsibilities no less extensive and perhaps even greater, when from the height of some resounding tribune we give, for example, advice on some doctrine of universal application, whose verity has been demonstrated by our experience, but which is none the less combatted by sincere men, fixed in their convictions or in their habits.

The scientific journals carry our discussion to the entire world where these contradictory counsels are followed or are combatted by all those who have confidence in us. So that a word spoken here may cause innumerable beings, some thousands of leagues from here, to live or to die, beings who will never know that they owe their lives to us, or that it is we who are the cause of their deaths.

Ah! Let us never speak lightly of these great questions, like some of those I have seen come up, whose solution can save human lives by the thousands every year.

And what evil to humanity would his contradictors have done to Pasteur, that great victor of the greatest battle of all time past and of all time to come, against sickness and against death, if their passionate attacks had, as they wished, torn from the great man the confidence which his faith in the truth of his cause gave him.

Peace to the memory of those men who, had they won, would have deserved the curses of humanity!

"I command or I say nothing," said Napoleon.

Let us take example from this great man.

Let us affirm only that about which we are sure, or let us say nothing.

But, always, let us appeal to something higher than our science, than our art, than our experience! And when a doubt comes to blight our spirit, let us invoke that which we feel to be the most pure in us, the most profound, the most sacred, the most inflexible: let us invoke our conscience.

This is not only a great word, one of those powerful and dominating words which, when one pronounces them bring to our minds a whole world of sentiment and stir all that is most noble in the hearts of men; it is a living reality for those who, like us, find themselves face to face at all times with the most distressing problems of duty.

For we are only men, fallible as all men, subject to uncertainity, exposed to error, sometimes lost in the shadows, and who, nevertheless, meet the duty of having to choose between the uncertain roads of life and death.

Ah! our duty is doubtless dazzling. Let us listen to the sublime rule: "Do unto others as you would have them do unto you!" and let us everywhere and always, adopt decisions which most conform to the interest of those who turn to us! But that is only a vain word, one of those sonorous words which are lost in the night. For the problem which is raised is precisely, "What is the decision most conforming to that endangered interest?" In fighting for a rapid cure, in fighting for life, the possibility is always present. And would we be discussing it thus if the shadow of death were not hovering over all our deeds?

Here is the real problem, one which is raised every day. And this is why at the moment of taking the resolution that must be taken, in the presence of him who comes to us and whose anxious look seeks to read our thought, we feel obscurely struggling in our soul the powerful reasons for acting, and those which, sometimes no less strong, counsel us to abstain. But we must choose, nevertheless, fully conscious that on that decision hangs the life of a man, a child, a young woman, already prepared to give another life. An irreparable condition is there, hidden in the shadows. It will necessarily be revealed by our decision. We shall know tomorrow.

Duty! duty! powerful word, sublime word, and one which is enough, as we have seen in tragic hours, to transport men to the exaltation of sacrifice. Duty, we must ask to lead and inspire us.

It is no doubt easier to sneak away and bury oneself than to throw oneself into the attack. But we know also that it is a serious thing to do nothing, and that a too comfortable abstention is very often more dangerous than the thing the weak and powerless call temerity.

That is why we, Surgeons, we who know the magnificent resources of our art, owe our trust to it. Let us have the creed of action. For it is through action that we triumph and that we are stronger than death.

When surgery has given what it has given, when it has rendered what it has rendered by its last fifty years of service, when it has furnished by its incalculable benefits the dazzling proofs of its value, let us, we who know, we who *can*, raise our souls above ever-easy slander, above calumny, above the too common accusations of incompetents or of the jealous, above the legitimate grief which undeserved misfortunes have provoked, since we have with us the impenetrable sanctuary of our conscience. And during those times when we are exposed to the evil-doing of certain laws, and to the ignorance of those who apply them, it is something to be able to find in ourselves this inviolable refuge which is above the justice of men and whose serenity the iniquity of certain legal decisions will not be able to disturb.

For it is not in legal codes or courtrooms, it is not in the chance decisions of magistrates, that we will find the sanctions of all the acts of our lives. It is in the deep ever-recurring joys which the good that we do brings to us, and it is also, alas, in the bitterness of grief-stricken hours which break our hearts, at the bedsides of the dying, whom we have not been able to save, and whom we are sometimes conscious of having hurried to death.

And where is he then, he who can set himself up as judge in all good faith? Outside of some rules whose absolute certainty has made a few incontrovertible laws, like those of asepsis, the negligence of which may be classed as a real crime; aside from a few rules which fall under the control of simple good sense, where is he, I repeat, who can constitute himself a judge. Who will arise to say to any one of us: "You are guilty because you have not given proof of a superior cleverness, of an unshakeable presence of mind, of an iron resistance to fatigue, qualities which are given to so small a number! You are guilty for not having been the faultless workman at your task, for not having felt that on the precise movement of your hands, on the sometimes instant action, depended the health or the illness of your patient, his happiness or unhappiness, his life or his death! You are guilty for not being the perfect man, when there is no perfection in this world." When will it be understood that there can never be either precise rules, or absolute laws, or even a common measure for the surgeon absorbed in the difficulties of his task?

For there is no common measure between the man who feels the lofty inspiration and sudden light seething and pulsing in his heart and the other, the perfect technician, the faultless operator, like those one meets in great numbers in countries of advanced medical education, but who remains incapable of raising himself above what he has faithfully learned, of feeling the divine spark burst forth.

For if you refuse to that man who bears in himself the power of the Master, the right to follow his inspiration or even his genius, who then will lead out of the rut the great art which we all serve and launch it into new paths? For fifty years it has been permitted to us to walk these well-known paths while the miracles of contemporary surgery have spread beyond limits of which our masters did not dream.

Soon it will be a half century that I have lived in the hospitals. For forty years I have breathed each day in a sort of spiritual communion, with the sick and those operated upon, with those who suffer to live and those who suffer to die.

When I see them ranged before me, in the evening of my memories, it is a people in a confused tumult which rises in my memory and whose vision fills me with pride and melancholy at the same time.

Poor lost sick children, defenseless and without understanding! Old men whom inexorable death already grasps! Young women condemned by the unjust travail of maternity! And you especially, you who were the grievous obsession of our days and nights for four years, young soldiers, sublime young men, whom the fatal accidents of history have thrown into the tumult of battle! You the heroes, you the martyrs of the immense hecatomb, whom I have seen lying in countless numbers in all the hospitals at the front, where one heard dimly the wings of death hovering above, but where so many of you found life again. What pains, what miseries, what unjust sufferings, how many innocent victims of a pitiless fate!

And now we are in the days when we see the last years coming, when we feel the hour approaching to lay down, in our turn, the arms which we have used for so long to drive back death.

Let us cast a glance backward into the mist of the past, so that our life work may unroll before our eyes. How many dead, how many dead! Their image now dim, now bright, alas, draws itself up before us. Many of them would perhaps still be living on this earth, if our judgment, instead of letting itself be guided by hope, had abandoned them to fate, and had refused to lead them to the table of blood, which for them was the altar of sacrifice, when for so many others it is the threshold of resurrection.

May our souls remain serene and our hearts firm before the image of these dead. For our souls were pure and our hearts sincere when we placed on them the predes-

tined hands which sought for health and found only death.

Innocent victims of the Fate which hovers over the world, these dead, these poor dead, have not died in vain. Just as much as the soldiers fallen in battle, they are the obscure artisans of the victory, and their unrecognized sacrifice finds its recompense in the health and joy of those saved.

How many dead! How many dead! How many living too . . . It is a whole people that rises. It is a whole world of living people who are giving, and will continue to give, life to others.

And there is that stronger, more intimate and deeper joy, for those who, in the meditations of their nights, or in the feverish inspiration of some moving moment have forged some new and decisive weapon against suffering and death. This will survive them and will prolong into the future their beneficent activity and will make the work of their brains a living thing, when their fame shall have disappeared and their name shall be stricken from the memory of men.

Gather together, gather together then, ye phantoms who have disappeared, yet who are living at the present moment, ye children of the future who people our spirits with your shadows and images; ye are the faithful companions of our memories and of our dreams, ye are our despair, our pride, and our hope!

Forgive us, ye dead of the past, fallen on the field of honor. Ye are fallen in the hard battle which we fought to preserve life. Console us, countless multitude of the living, multitude of those whom we have saved, who very often appreciate us no longer. Console us, children of the future; although ye will not appreciate it, we gave life back to those who will give it to you. Gather together, dead and living. Let your silent images rise before us. And before the silent throng of all those who owe and will owe their lives to us, as well as those whom we have hastened into death, let the voice of our conscience mount into the silence and come to murmur to the echoes of our souls that the work of our lives has not been in vain, that we will have passed over the earth like the plowman who fertilizes the plain, scattering to the four winds of heaven the seed of future harvests.

# BOOK REVIEWS

Piersol's Human Anatomy. Including Structure and Development and Practical Considerations. Ed. 9, Revised under the Supervision of G. Carl Huber, M.D., SC.D, 2124 pp., 1734 illus., of which 1522 are original and 460 are in color. Phila., J. B. Lippincott Co., 1930.

A truly American textbook and a good one! The reviewer well remembers when a new star burst upon the Anatomical firmament in 1907 and it is with a feeling of sadness that it is noted that of the five men who collaborated at that time only one is still living. Each of them, however, would be proud of this ninth edition of what has, in truth, become a classic. Dr. G. Carl Huber, Professor of Anatomy at the University of Michigan, edits this edition and in the Preface assumes full responsibility, though he has had the able assistance of Drs. E. L. Eliason, E. P. Pendergrass, R. E. McCotter, E. C. Crosby, L. H. Strong and J. F. Huber. A consistent and uniform B. N. A. Nomenclature has been adopted and the newer Neuro Anatomy has been included. In order to make one volume of over 2100 pages thin paper has had to be used, and for this reason the illustrations, of which there are over 1700, do not show up as well as they might. However, as a student's text, the new Piersol may be recommended without reservation.

History of Medicine in Nebraska. By Albert F. Tyler, M.D., Editor, Ella F. Auerbach, Compiler. 670 pp. Illus. Omaha, Magic City Printing Co., 1928.

An interesting work particularly, of course, locally. However, books of this kind, giving the story of medicine in important states and cities, telling of the pioneers and of the men who have assisted in the development of medical science in that community, with the story of the conditions faced and of the medical schools and hospitals founded, make important source material for medical historians and must furnish a great incentive to the younger physicians of the community.

It is interesting to note that in the story of Nebraska, the point is made by the Editor that "There are still present in our midst two surgeons, J. E. Summers and A. F. Jonas, who were the first in Nebraska educated after aseptic methods were introduced. When they came, the late Victor Coffman was doing ovariatomies, wearing flannel sleevelets over his shirtsleeves to keep them from getting soiled. Tracheotomies were a frequent emergency operation in diphtheria cases because of the lack of antitoxin." It is perhaps well to be reminded in this manner that the proverbial "good old days" included the days before asepsis and that they are so close to us, that there are men active in surgery today who practiced at that time.

The description of the publications issued from Nebraska makes interesting reading, as is the story of the development of hospitals, and medical schools.

All in all, it is a fascinating book and one that we would like to see duplicated for every state in the Union.

Legal Medicine and Toxicology. By Ralph W. Webster, M.D., PH.D. 862 pp., 4 plates, 48 illus. Phila., Saunders, 1930.

There has been felt a distinct need for a one-volume, authoritative and up-to-date work on Legal Medicine and Toxicology. This is met by Dr. Webster's book which will be found valuable for reference by every practicing physician and surgeon. Concise and to the point, it covers an unusual amount of ground and will answer most questions in sufficient detail for the average physician's use. Extensive references make it easy to get further information without undue effort. The first chapter on "Legal Rights and Obligations of Physicians" will probably be the most used in the entire book and it is alone worth the price of the volume.

Selected Readings in the History of Physiology. Ed. by John Farquhar Fulton, M.D. 337 pp., 61 illus. Springfield, Charles C. Thomas, 1930.

In this book are selections from the writings of those who have contributed to the development of Physiology, beginning with quotations from Galen and Aristotle, through such modern authors as Cannon, Pavlov, and Cushing. The author has a flare for selecting from an author's work just that material that presents his viewpoint best. Not intended as a History of Physiology, this book actually gives in concise and readable form the source material forming the basis of such a History.

No better argument for the presentation of material of this kind to medical students is known to the reviewer than the author's suggestion to let the student "realize that men as young as himself have made important contributions: that de Graaf at twenty-three years of age devised the first pancreatic fistula; that Helmholtz at twenty-four measured for the first time the heat production of frog muscle; that Johannes Müller at twenty-five had enunciated the principle of specific nerve energies. Let him discover that simple facts were once hidden in a fog of faulty observation and faulty reasoning, and that it was sometimes the enquiring minds of students like himself that made matters clear."

Dosage Tables for Roentgen Therapy. By Professor Friedrich Voltz, Head of the Radiological Department, University Clinic for Women, Munich. London, Oxford Univ. Press, 1930.

This little volume is peculiarly valuable for the radiotherapist, but all too brief. Chapters one to four inclusive discuss the spreading, absorption, and scattering of *x*-rays, and the various factors that enter into the estimation of the *x*-ray dosage, including the physical dose, the biological dose, the dose quotient, the percentage deep dose, the effective dose, the practical dose, and the absolute unit of dosage. The various methods of measurement are also briefly set forth. Then follow three groups of tables: 1, tables of intensity, time, and space factors; 2, tables of intensity and absorption factors; 3, tables of practical doses. The final chapter relates to the biological and to the physical calibrations.

This book is a translation from the second German edition, with the object of assisting the practical radiologist to estimate dosages without the necessity of long physical measurements and repeated calculation. It is, of course, devoted entirely to the estimation of physical quantities. The author explains that whatever stress is laid upon biological factors, it must always be remembered that the biological effect of *x*-rays can only be ascertained quantitatively by means of physical constants.

A Century with Norfolk Naval Hospital, 1830–1930. A story of the oldest Naval Hospital, the Medical Department of the Navy, and the progress of Medicine through the past one hundred years. By Richard C. Holcomb, M.D., F.A.C.S. 543 pp., 42 illus., Portsmouth, Printcraft Publishing Co., 1930.

Combined with the story of the oldest Naval Hospital in the country, Dr. Holcomb has succeeded in giving us a splendid story of the rise and development of the Medical Department of the Navy. Having spent four years in charge of this Hospital, the author had access to the official records and his story is well documented. This work, which is a distinct contribution to the medical history of the United States, will be found fascinating, as well as instructive reading. As the author points out, "the story is inseparable from the chronicle of progress made in the medical sciences, which actuates the development of all hospitals, and being a Naval Hospital it is sensitive to those political and economic influences which have tended to develop the Navy." For this very reason, there are many interesting sidelights on the history of our country.

The illustrations are well chosen and the work is printed on a tinted paper, making a book that, besides its interest as a scientific and historical production, is a distinct typographical addition to any library.

Primer on Fractures. Prepared by the Cooperative Committee on Fractures under Auspices of Section on Surgery, General and Abdominal, and Section on Orthopedic Surgery in cooperation with Department of Scientific Exhibit of the American Medical Association. 55 pp., Illus. Chicago, American Medical Association, 1930.

This book is made up of the folders prepared by the Cooperative Committee on Fractures for the demonstration of proper handling of fracture cases presented at the annual Scientific Exhibits of the American Medical Association since 1927. The Committee emphasizes the fact that "the purpose of the Primer is not to standardize treatment of fractures; it is to suggest what, in the opinion of the Cooperative Committee on Fractures, constitute acceptable methods of treatment." The illustrations consist of drawings of the actual Exhibits. This little work may be accepted as an authoritative statement of the best modern treatment for the handling of fractures.

Medical Art Calendar for the Year 1931. 28 pp., 27 illus. The Hague, J. Philip Kruseman, 1930.

No more desirable calendar for the physician's office can be imagined than this one of twenty-eight pages, each with a splendid reproduction of an old portrait, title-page or other item of interest in medical history. So well are these illustrations reproduced that they may well be kept to form an album. It will be a credit to any library on medical history.

The enterprise of the Dutch publisher in issuing this work with English, as well as with Dutch text, is to be commended. It is to be hoped that some enterprising American publisher will provide us some day with a similar calendar.

Die Therapie der Wiener Spezialärzte. Bearbeitet von den Fachärzten Wiens. Herausgegeben von Dr. Otfried O. Fellner. Dritte, vermehrte und verbesserte Auflage. 678 pp. Berlin, Urban & Schwarzenberg, 1930.

This practical little book is of the old-fashioned type for practical quick reference. Since it is alphabetically arranged, one may quickly turn to it when in a quandary and in a few lines, or at most a page or so, obtain a short description of the most modern methods of treatment, at least, as carried out in Vienna. Each article is signed by a recognized authority. It should be kept on the office desk. The amount of material included in the less than 700 pages is really astounding. The publishers are to be congratulated on the fact that the type is large and distinct and that they have

not made the sacrifice that is so common now, of condensing material by the use of type that requires a magnifying glass to read.

LES PLEXUS CHOROIDES—ANATOMIE—PHYSIOLOGIE—PATHOLOGIE. By Mme. le Dr. Nathalie Zand. Preface by Professeur Roussy. Paris, Masson et Cie, 1930.

This is an exhaustive study and comprehensive discussion of the choroid plexuses from the standpoint of anatomy, physiology and pathology. The author subscribes to the modern theory by which the arachnoid is considered as a single connective membrane, intimately associated with the pia mater and forming the connective tissue stroma of the choroid plexuses. In her study of the function of the choroid plexuses, Dr. Zand discusses in detail the mechanism by which the cerebrospinal fluid is produced. There is still great controversy on this question. Physiologists and histophysiologists have a tendency to consider cerebrospinal fluid as a product of secretion, whilst chemists assimilate the choroid plexuses to a dialyzing membrane. Dr. Zand's researches lean strongly towards the first opinion. Particular attention is given to the study of the nature of the arachnoid cells found in the connective tissue stroma of the choroid plexuses. The epithelium covering the plexuses is said to differ morphologically and physiologically from that which lines the ependymal cavities. At the end is an important study of pathological conditions of the choroid plexuses and the ependyma, a good presentation of the various alterations of the choroid and ependymal epithelia associated with pathological conditions. This monograph contains so many new data on the choroid plexuses that the research worker, engaged in the exploration of this particular field, will find in it a wealth of information.

DIAGNOSTIC ET THERAPEUTIQUE ELECTRO-RADIOLOGIQUES des Affections du Systeme Nerveux (Electro-radiological Diagnosis and Treatment of Nervous Diseases). By A. Zimmern, Assoc. Prof., Faculty of Medicine of Paris and Dir. Medical Institute of Electro-Radiology, and J. A. Chavany, Chief of the Clinic of the Faculty of Medicine of Paris, Physician to the Municipal Institute of Electro-Radiology. 654 pp., 254 figs.; Paris, Masson et Cie, 1930.

The perusal of this well gotten up and attractive book reveals to how large a degree electrodiagnosis and radiology have contributed to the diagnosis and treatment of diseases of the nervous system.

The first part is devoted to electrodiagnosis of the motor nerves and of the muscles and of sensory disturbances.

The second part discusses radiological diagnosis of the bony envelope of the brain and spinal cord, and of the various clinical manifestations of nervous diseases. Abundant attention is given to encephalography and ventriculography, adequate credit being given to American and European physicians who have contributed to the development of this method.

The third part considers methods of treatment, faradic and galvanic currents, franklinization, high frequency current, diathermy, radiotherapy, radium therapy, and actinotherapy.

The remainder of the book is devoted to the diagnosis and therapy of the various affections of the nervous system. The final chapters are devoted to diseases of the muscles and paraneurological syndromes, such as exophthalmic goiter, tetany, spasmophilia, hysteria, etc., with a final brief note on neurasthenia.

The numerous illustrations, most of which are satisfactorily reproduced, add much to the value of this work. Because of the detail and completeness of the text and because of the inclusion of the most recent methods, this book should prove valuable both to the electroradiologist and to the professional neurologist. The general practitioner will find very much in this work to help him in the recognition of neurological difficulties of his patients.

MEDIZINISCHE PRAXIS Sammlung für Ärztliche Fortbildung. Herausgegeben von L. R. Grote, A. Fromme, K. Warnekros. Band VIII, GRUNDZÜGE DER NEUROCHIRUGIE von Prof. Dr. Med. Walter Lehmann. 209 pp., 23 illus., Dresden, Theodor Steinkopff, 1930.

An interesting, short and concise presentation of the Neurosurgery of today including a good bibliography for further reading. Of course, covering the entire subject of Neurosurgery in less than 200 pages, means that the book does just what its title indicates, presents merely an outline of the subject for rapid reference by the surgeon. This purpose has been well carried out.

# PRINCIPLES OF PREOPERATIVE & POSTOPERATIVE TREATMENT

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# PRINCIPLES OF PREOPERATIVE & POSTOPERATIVE TREATMENT

## INTRODUCTION

### 1. The Importance of Preoperative and Postoperative Treatment in Surgery

THE history of surgery has been both long and honorable, and the tremendous advances of recent times made possible by the discoveries, first of general anesthesia by Crawford W. Long in 1842, and later of the rôle of bacteria in the production of infection, has placed the surgeon far out in the vanguard of the march of medical science. Modern surgery is now accomplished for the most part with a precision, expedition, and technical excellence which offers a serious challenge to the future if the established rate of advance is not to be retarded. Ingenious surgical instruments have been devised, operating-room technique has been perfected to such a point that the infected operative wound has become a sharp reproach to the surgeon and his assistants unless there be some legitimate source to which the infection can be traced, and operative procedures have been standardized to such an extent that the names of almost all the various surgical manipulations are constantly on the lips of the medical profession at large. Minute descriptions of these manipulations may be found duplicated again and again in readily accessible literature.

Under these circumstances it is not surprising that the practice of surgery presents no narrow confines and that many students of the healing art embrace the functions of the surgeon either habitually or from time to time, as the occasion arises, and in many cases do so with much benefit to the patient and with due credit to themselves. That such a happy outcome results only in possibly a large percentage of cases must be admitted, however, for there is a difference between the master surgeon and the neophyte which consists far less

in technical skill than in that intangible quality which is sometimes called "surgical judgment" for want of a better term and which includes not only (1) a practical knowledge, born of experience, of the possible complications and probable outcome of mechanical maneuvers as such, but also (2) so comprehensive a grasp of the fundamentals of medical science that its possessor instinctively and clearly visualizes both the abnormal and the normal bodily processes of his surgical patient, as well (3) as that divine gift of common sense so to adapt the treatment to the individual patient that under the particular conditions presented by the particular sick person the most benefit may accrue in the shortest time.

Measured by the standards inherent in this concept, operative technique is a distinctly subordinate part of the practice of surgery, whereas surgical diagnosis, together with that part of the treatment of surgical cases which is conducted outside the actual operating room, bulks correspondingly large. Many good treatises on surgical diagnosis are available, and indeed the fundamentals of the art are the basis of undergraduate surgical instruction everywhere and constitute the subject matter of many pages in all of the standard textbooks in surgery; but with rare exceptions, if the amount of space given to the consideration of the preoperative and postoperative care of surgical cases could be taken as a criterion of its importance, the assumption would inevitably force itself upon one that the surgeon, after making his diagnosis, ushers the patient into the operating room a sick man and soon thereafter removes him thence quite cured of his disease. Such a concept is, of course, highly absurd.

## II. The Importance of Consideration for the Patient in Preoperative and Postoperative Treatment

No less a figure in modern surgery than Lord Berkley Moynihan has found it necessary to emphasize the axiomatic truth that the most important person present at any operative procedure is the patient himself. If the importance of con-

sideration for the patient in surgery needs to be emphasized in connection with the conduct of affairs in the actual operating room, how much more important does it become in the more prolonged preoperative and postoperative periods?

Even in spite of the discouragingly high percentage of diagnostic failures reported in the current literature from time to time and in face of the fact that, especially in abdominal surgery, the human body proves a veritable temple of surprises to the exploring knife, there is no excuse for leaving a single stone unturned in the search for evidence which will prevent unnecessary surgical maneuvers or which will tend, even in small degree, to mitigate the suffering, shorten the convalescence, and eliminate the economic waste incident to operative manipulations on human beings. Only in those cases in which the operating surgeon is willing to recognize the diagnostic and prognostic superiority of another is he justified in delegating the preoperative care of his patients to such a one; and by the same token that surgeon who assumes the entire responsibility for the preoperative care of his cases, especially those which present features usually considered as falling properly within other fields than his own, either convicts himself thereby of delinquency toward his patient or places himself in the position of assuming to consider his own judgment superior to any other available at the time.

As to the postoperative period identically the same reasoning must be considered to apply. During any actual operative procedure it may be said parenthetically, there is relatively little danger that the best interests of the patient will fail to be safeguarded, since, characteristically, the surgeon, as well as his assistants, are keenly intent upon the task in hand, possessed of the knowledge that their own personal prowess is dependent upon bringing the patient safely through his immediate ordeal. The situation tends to be somewhat reversed, however, when the focus of attention has shifted to other matters and the patient has been turned adrift more or less on his own resources to weather the storm of recovery.

Too frequently there is a temptation for the surgeon to shift the onus of responsibility during this period to other shoulders than his own; even a surgeon who jealously guards his reputation as an operator and who counts no sacrifice too great in the attainment of technical excellence sometimes hesitates to give equally freely of his time and energy to the complete rehabilitation of his surgical charge. Surgical success consists, in its highest interpretation, not in the number of human bodies placed under the knife or in the brillancy and cleverness with which extensive abnormal processes may occasionally be corrected, but in the general restitution of unfortunate individuals to positions of usefulness in the social economy.

## III. The Importance of Cooperation between the Surgeon and His Associates Outside the Operating Room

Perhaps it may seem trite to observe that proper preoperative and postoperative care can be given patients only when there is the heartiest cooperation between the surgeon and all of his associates. It is, of course, only proper in a profession such as surgery that the expert should be accorded a full measure of respect, but the maintenance of personal dignity and a bearing calculated to command respect is not at all inconsistent with that attitude of kindness and consideration for others which inspires the cooperative spirit in the subordinate. The attitude of false superiority which one can so readily assume and which prompts one to issue now an order for this and now one for that, without taking those responsible for the carrying out of those orders into one's confidence either with respect to the indications for the treatment prescribed or with respect to the result desired, calls for nothing but condemnation. One who assumes this attitude is culpably careless, dubious as to his own abilities and understanding of the case he is attempting to treat, or devoid of proper consideration for others.

Cultivation of the cooperative spirit should begin early in the surgeon's career. Almost invariably the tendency for the neophyte placed for the first time in a position of responsibility is to attempt to obscure his ignorance and inability to cope with the situation in hand by reticence and the assumption of a dictatorial manner. On the one hand such an attitude works a very real hardship on one's associates, and on the other hand it is apt to jeopardize one's own position, for subordinates often have a specialized knowledge superior to one's own, which the wise surgeon can turn to his own advantage. First, as a hospital interne, the surgical neophyte should begin to realize that there are many matters, at least many matters of a routine and mechanical nature, which the attending nurse is by training far more competent to perform properly than he. Accordingly, without debasing himself either in his own esteem or in hers he should go out of his way to make the utmost use of her assistance; he should observe her technique especially in the simple matters connected with the intimate care of the patient, the placing of pillows, the manipulations incident to the changing of a patient's position in bed, the placing of hot water bottles and ice caps, the making and straightening of the bed, ventilation, and the like. The nurse on her part, observing this interest and at the same time recognizing the more complete and more prolonged training of her medical superior, will come to feel less and less hesitancy in communicating to him her observations concerning the patient, and furthermore will stimulate him to more exact and scientific observations on his own part by her questions and interest. As time goes on, and the simpler clinical matters are mastered, the successful interne will progress to a position in which he is placed over other internes or will be given an appointment in which he comes more or less to supervise the movements of other less mature members of his profession. Continuing the same process of consulting with, and making use of, the resources of those associated with him, his interest and knowledge will broaden

accordingly. Undoubtedly more time and energy are expended in this way than would be expended by assuming an attitude of superiority and aloofness, but the added effort will bring its own rewards both in the attention which his patients receive from attendants, nurses, and internes but also in the added esteem in which he himself is held by his associates and subordinates. He will eventually come to be regarded not only as a good clinician, but as a good executive; with this his practice will enlarge, and financial dividends will also begin to be realized.

Such a surgeon, for a surgeon he has become in the meantime, will freely express his impressions as to diagnosis and treatment as he moves about with his staff; sometimes these judgments will require revision subsequently, diagnoses will be changed, the form of therapy will be revised, but if these duties be performed openly and without dissimulation the respect of a surgeon's subordinates is never jeopardized, and not very infrequently the most valuable observations and suggestions will be forthcoming, under these circumstances, from very unlikely sources.

The good surgeon is invariably a good teacher; the lessons he has learned in the school of experience he passes on whenever he can to those of less experience, and in so doing helps those about him, but helps them in no such degree as he helps himself, for there is no way of learning which in any respect compares in efficiency with the attempt to impart knowledge to others.

## IV. The Importance of Principles in Preoperative and Postoperative Therapy

Even with the closest kind of cooperation amongst all concerned in the adequate preparation of a patient for operation and with adequate care in the safeguarding of his convalescence thereafter, the rationale of preoperative and postoperative care is neither easy to grasp on the part of the neophyte nor to outline on the part of the master. This is

partly, at least, on account of the very simplicity of the measures of established value that can be employed to the ends desired and the complication of cases to be treated thereby. Nothing could be further from the truth than that one to be adept in the care of surgical patients must be master of many complicated techniques and possessor of a large medicinal and instrumental armamentarium. Just as in the case of the internist, although the pharmacopeia contains many drugs and preparations of drugs, only relatively few of which are of any considerable breadth of application, and with the aid of these few the whole gamut of diseases must be treated as far as medicines go, just so, in the case of the surgeon, only relatively few of a large number of (especially postoperative) methods which have been tried have established themselves as applicable to any considerable number of cases and as being of sufficient value to endure. The hypodermic syringe, the stomach tube, the blood pressure apparatus, and the stethoscope constitute the bulk of the armamentarium of the surgeon outside the operating room, especially if the variations of these be included, such as the infusion, transfusion, rectal drip, enema, douche, and duodenal drip apparatuses. About the only especial mechanical skill needed in the average case is the ability to introduce a needle or cannula into a vein, and this can be acquired in a relatively short period of time. Even fewer drugs are found useful in surgery than in medicine.

Accordingly, the aim of the attendant on surgical cases outside the operating room should not be to acquire familiarity with a large number of special remedies or to elaborate cumbersome techniques, or even to keep his ear too close to the ground for the approach of some new surgical panacea, but rather should he aim to master indications for the measures which have been repeatedly assayed and not found wanting. Ultimately the practice of medicine resolves itself into a process of reestablishing normal processes which have become perverted through disease and, apart from a thorough under-

standing of the normal processes and the manner in which perversion of these processes occurs, the treatment of abnormalities becomes a hit or miss affair. If the therapeutic fads and fancies which so often make insistent claims on the attention of the medical man be heeded and allowed to usurp the place of sound reasoning and careful observation, disaster can hardly be averted. Not infrequently the very complexity of a piece of apparatus or a system of therapy is enough to condemn it and this for two reasons: (1) the complexity of the apparatus or system becomes a matter of pride rather than its efficacy, and (2) human nature being as it is, the simpler a performance can be made the more likely it is to be invoked when needed.

Nature is most kind in healing diseases, as she is most cruel in sending them; consequently the medical attendant should beware of becoming so overzealous in his attempt to combat morbid processes that he becomes actually meddlesome. Any insult to natural processes is likely to be resented by the human organism in no uncertain terms, and it behooves one to consider well one's therapeutic position before attempting to invoke measures concerning the rationale of which one is in doubt for the relief of conditions which one imperfectly understands. The conscientious medical attendant continually finds himself in a dilemma between the two horns of which he is constantly torn; shall he let well enough alone in the belief that the sum-total of the forces working for recovery are in the ascendency or shall he interfere in the belief that the day is with the forces working for dissolution? Unfortunately there is no divining rod by which the decision may be made; in the case of preoperative and postoperative treatment, as in every other branch of the practice of medicine, knowledge comes with experience and is bought only at the price of assiduity of application over a long period of time.

In surgical practice, as well as in the practice of medicine in general there can be no rational therapy without rational diagnosis. The laboratory is the surgeon's sheet-anchor in the

time of storm; accurate and reliable blood counts, serological tests, blood-chemistry examinations, urinalyses, and bacteriological examinations elucidate many an obscure complication in surgery when interpreted by a well stocked mind and keenly analytical intellect. The surgical case presents almost as many diagnostic problems as the case in the medical ward during the course of his stay in the hospital; many cases present almost daily problems for solution.

It should be axiomatic that in the absence of definite indications for therapy no therapy should be attempted. The principle involved in the use of routine or "standing" orders and stereotyped schedules which go by the clock is fundamentally unsound in medicine, and although a moderate degree of failure to individualize cases may not be actually detrimental to the interests of the surgical patient, the march of events in a surgical ward is characteristically much faster than elsewhere in a hospital, and usually when active treatment is needed it is not only needed at once but the treatment required is not that prescribed by any set form.

# Chapter I

# GENERAL PRINCIPLES UNDERLYING RATIONAL PREOPERATIVE TREATMENT

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## Chapter I

# GENERAL PRINCIPLES UNDERLYING RATIONAL PREOPERATIVE TREATMENT

### I. The Aim of Preoperative Care

The general aim or object of the preoperative care of surgical patients is threefold:

(1) the establishment of a full and complete preoperative diagnosis;

(2) the minimizing of the risk incident to the contemplated operative procedure as such, especially by attention to the stabilization of metabolism, selection of the optimum time for operation, and the correction of such associated morbid conditions as are amenable to medical or minor surgical therapy;

(4) the prophylactic treatment of postoperative complications.

### II. Emergency Operations and Deliberate Operations

In those cases in which the time factor is of no particular moment or in which the general condition of the patient is favorable and the need for operative interference is not pressing, the accomplishment of the threefold object of preoperative care may be virtually complete. Such preparation sometimes occupies a number of months; for example, in the patient with umbilical hernia, who is characteristically overobese, in middle life, and therefore apt to be the subject of incipient nephritis, and who usually has an associated fatty degeneration of the heart. Such a patient usually requires dietary therapy aimed at the reduction of the obesity, which latter, if severe, would militate gravely against the success of any surgical procedure designed to restore the integrity of the abdominal wall. Nephritis, if moderately advanced, may require additional dietary restrictions to prevent untoward

urinary complications postoperatively. Myocarditis may require an especial study of the heart and the institution of additional measures aimed at the prevention of possible postoperative cardiac failure. In such a case the preoperative treatment may obviously mean the difference between success and failure and cannot by any stretch of the imagination be crowded into a period of time measured by hours, days, or even weeks.

On the other hand, in those cases in which the life of the patient depends upon expedition in the matter of operative interference, as in the case of a strangulated hernia, ruptured peptic ulcer, or ruptured ectopic pregnancy, the preoperative care may be extremely incomplete, the patient being placed upon the operating table with virtually no preoperative care at all. In such cases the patient may succumb, may recover after a stormy convalescence, or may make an uneventful recovery depending upon circumstances very largely beyond the surgeon's control.

The distinction between the two foregoing types of cases has frequently been drawn in the past. They represent respectively the "operation of election" or the "deliberate" operation and the "operation of necessity" or the "emergency" operation.

The three objects of preoperative treatment previously mentioned must not be considered as in any sense mutually exclusive or unrelated; actually they are usually correlative. This can best be illustrated by a specific example. Taking, for instance, the case of the young adult who is suffering from indigestion of several years' duration, which indigestion ensues with regularity an hour or two after meals and is relieved by the taking of sodium bicarbonate and food, and in whom physical examination, roentgenographic studies, and analyses of gastric contents indicate the presence of peptic ulcer, adequate preoperative treatment involves a number of features which considered from one point of view fall within one classification of the preoperative care, whereas considered

from another point of view they fall under another classification. The *institution of a period of medical treatment* not only may confirm the diagnosis, which confirmation is a part of the first mentioned aim of preoperative care, but it may also increase the general resistance of the patient, which, in turn, on the one hand, tends to minimize postoperative wound infection (a part of the third object of preoperative care) and on the other hand, renders him a better immediate operative risk (a part of the second object of preoperative care). The *eradication of foci of infection in the mouth by the extraction of teeth*, on the one hand, may overcome an anemia secondary to that infection and thus minimize the immediate risk of operation, which is a part of the second object of preoperative care, while at the same time eliminating a possible source of postoperative pulmonary complications, for example, pneumonia, which is a part of the third object of preoperative care.

In those cases in which there is a choice in the matter of the time of operation, frequently that surgeon is wisest who relies not altogether on his own resources in preparing his patient for the ordeal of surgery. Those cases falling within such a classification which present the most trying preoperative problems are almost invariably victims of organic diseases which, except for some incidental surgical complication, are proper subjects for the attention of the practitioner of internal medicine or one of the allied specialties. As outstanding examples of such cases may be mentioned, to catalogue but a few, patients with tuberculosis, diabetes, advanced nephritis, and advanced cardiac disease. Unless the surgeon belongs to a small gifted group of practitioners whose knowledge and experience justify the practice of truly "general medicine," patients such as these should have the benefit of the combined preoperative medical judgment of at least two consultants, the surgeon and the internist, and an attempt should be made by both practitioners in the most unselfish spirit to pool their resources.

This is usually not only a fairly easy matter, but one which, if properly handled, is capable of extending the professional influence of both types of practitioner. Surgical cases are usually referred to the practitioner of surgery by the practitioner of medicine, and the enlistment of the latter in the general care of the patient both preoperatively and postoperatively offers in many cases the possibility of a satisfactory solution of the problem of the equitable adjustment of fees, a problem which for years has been an active subject of debate whenever cases are referred to surgeons for advice and treatment.

## III. The First General Object of Preoperative Care, or the Importance of an Adequate Diagnosis

With regard to the determination of a diagnosis Bailey[1] makes the following very pertinent observations:

> The making of a surgical diagnosis resolves itself into seven stages—usually not more than three or four of these will be found necessary in any specific case.
>
> 1. The taking of a history, and the general observation of the patient.
> 2. The elicitation of physical signs.
> 3. A mental process on the part of the surgeon whereby 1 and 2 are sifted and correlated, and a logical conclusion is drawn.
> 4. A differential diagnosis is entertained: this is also a mental process—largely one of exclusion, but reinforced when possible by further physical signs.
> 5. A scientific confirmatory test—usually performed by a colleague—e.g., *x*-ray, chemical, bacteriological, and histological examinations.
> 6. The more accessible parts of the interior are rendered visible by ingeniously constructed tubes, such as the cystoscope, sigmoidoscope, esophagoscope.
> 7. An exploratory operation is performed.
>
> If a diagnosis is still found wanting after the seven stages and combinations thereof have been exploited, there remains but one last court of appeal, the post-mortem room.
>
> The seven stages may be termed the "surgical crescendo."

Of these seven stages the first three are by far the most important; so important in fact, that to a very large extent they determine all the others, for if the history and the physical

signs have been inadequately or incorrectly elicited or if illogical conclusions have been drawn from even properly elicited history and physical signs, there is likelihood that confirmatory tests, special examinations, and the like will not be employed, or if employed will not be able to correct original faulty impressions.

Since the fundamental concern of this treatise is not with diagnosis but rather with treatment, the matter of history taking, physical examination, and special examinations can receive no more than passing mention. Such consideration as is paid to these matters in the brief paragraphs which follow is offered merely for purposes of emphasizing the fundamental importance of completeness, common sense, and honest effort in surgical diagnosis.

A. HISTORY TAKING: The taking of a good history is an art, the fundamentals of which may, nay must, be learned from some good textbook on the subject, but the mastery of which comes only from assiduous application to the art in a long series of cases and over a period of time measured, not in months, but in years, and best under the strict tutelage of a mentor.

The surgical master elicits a history apparently without effort and as a matter of instinct; the neophyte does the same laboriously, after many fruitless meanderings, and incompletely. Like the mastery of one's native tongue, history taking is learned not by speaking, but by writing. In contradistinction to spoken language written language must be precise, orderly, reasonably complete, and legible, in order to be intelligible; consequently, the practice of writing histories tends to discourage ambiguity both in thinking and in expression, tends to force one into habits of mental orderliness and a reasonable degree of thoroughness, and ultimately facilitates rapid and accurate thinking in the absence of actual writing.

The first histories of a beginner should be painstakingly complete, and should follow a system, the particular system

being of much less importance than the completeness of the same. Final history taking at the bedside should be discouraged, at least for a considerable time during the formative period of the surgeon's career, in favor of roughly drafted notes which may subsequently be rearranged in the form of a finished history; such a practice discourages the mere following of a set form and tends to enforce a certain amount of active cerebration on the part of the medical historian. The aim of the latter should be gradually to become so expert in recording an anamnesis that irrelevant and negative aspects of the history may be omitted without jeopardizing the completeness of the report, the history detailing the building stones out of which the diagnostic edifice is constructed rather than recounting the mass of by-products and waste material which must be discarded during the process of its construction. Good histories need not be lengthy, but they must be complete and must be in such form that they convey all the essential details of the case to the reader's mind without subjecting him, whoever he may be so long as he has a modicum of medical knowledge, to very serious mental exertion in assimilating the same.

B. THE PHYSICAL EXAMINATION: There is probably no way, save one, in which a person who is entrusted with the care of surgical cases may become apprised of the necessity of careful and complete physical examinations, and this is by experience. One who has removed an appendix to relieve the "referred" abdominal pain of a basal pneumonia of the right lung and who has been subsequently subjected either to the amusement of his confreres or the self-examination consequent upon a fatality will not willingly fall into the same snare on a subsequent occasion. Neither will the surgeon who, some months after officiating at a gynecological operation, sees his patient for an inoperable carcinoma of the breast speedily forgive himself if he cannot find among his records a note to the effect that on the former occasion the

breasts of the particular patient concerned were duly examined and found normal.

1. *The Routine Blood and Urine Examinations:* Blood and urine examinations are made with the express object of shedding light upon the diagnosis of a case or upon the operative risk involved, not for purposes of adornment of the history sheet. The importance of laboratory work has frequently been so forcefully impressed upon the mind of the medical man of the present generation that he has a definite mental tendency, somehow, to esteem this form of activity as an end in itself, and to feel that as long as the "laboratory work" has been done on a patient, that patient has at least received some benefit. This attitude is, of course, absurd; unless laboratory reports can be interpreted intelligently and are, in fact, so interpreted, the patient or hospital, as the case may be, might better be saved the considerable expense and often the inconvenience, as well, which is incident to the performance of such tests.

2. *Special Examinations:* X-ray, basal metabolism, cystoscopic, and other special examinations must be made on patients as indications for the use of these various techniques arise. It would be futile to disparage these methods, which in the hands of competent persons, are of the utmost value, and such is far from the intention of those who sound a note of warning in connection with these advanced methods of diagnosis and treatment. There is a very general feeling among the better informed practitioners of surgery, however, that special examinations can be much overdone and that between special examinations poorly and inadequately performed and good surgical judgment used in the absence of such special examinations there can be no choice but the latter.

c. The Meaning of "Complete Diagnosis": When the history of a surgical case has been carefully taken and the results of a thorough physical examination have been duly noted, the surgeon is, for the first time, in a position to make a satisfactory diagnosis. Such a diagnosis will include not

only the disease or disease syndrome from which the patient is primarily suffering, but will comprehend associated and apparently unrelated abnormalities.

If the case is one of intra-abdominal disease, such a diagnosis as "acute appendicitis," "tuberculous pertonitis," "peptic ulcer," "gastric carcinoma," or "acute cholecystitis" is by no means adequate, since in the last analysis, not these lesions, but the condition of organs quite outside the abdomen may determine the actual outcome of any attempt at operative interference. If the lungs are the seat of extensive tuberculosis, the circulatory system weakened by advanced myocarditis, or the function of the kidneys decreased by progressive nephritis, even a technically perfect intra-abdominal operation may result fatally. The same applies not only to organic disease of the pulmonary or cardiorenal systems but to disturbances of metabolism, such as diabetes and disturbances of the acid-base balance. Complicating thyroid disease, persistent thymus gland, icterus, adrenal insufficiency, severe anemia, hemophilia, and a host of other abnormal conditions may also lead eventually to a fatality.

In addition to the factors which make for mortality there are many others which make for morbidity, such as, carious teeth, diseased tonsils, adnexal disease in the female and prostatic disease in the male, cystitis, pyelitis, furunculosis, otitis media, chronic malaria, and a considerable number of others.

D. THE RELATIONSHIP OF DIAGNOSIS TO TREATMENT: No attempt will be made here to consider exhaustively the relationship of associated disease to surgery; the subject is far too broad and involves too many digressions into the field of internal medicine and the surgical specialties. A very brief consideration of certain complicating organic and functional diseases will be attempted in the following pages, but the primary recognition of such pathology is far more likely to be missed than the treatment and for this reason is infinitely more important. The actual treatment of disease is constantly

in a state of flux, and no man can hope to assimilate all of its ramifications, but really noteworthy therapeutic advances in this day and age receive so prompt and far-reaching publicity that the surgeon who is even a moderately assiduous student of medical literature is in little danger of overlooking them. For this reason the surgeon who is capable of recognizing or diagnosing disease is almost invariably in a position to treat it intelligently or at least to place himself in a position to treat it intelligently. Thus does diagnosis become the key which unlocks the door of treatment.

## IV. The Second General Object of Preoperative Care, or Minimizing Operative Risks

A discussion of the problem of operative risks and the methods available for minimizing them can be only arbitrarily separated from the problem of the prophylaxis of postoperative complications, for it is decidedly the rule for patients to survive the actual ordeal of surgery and, in fatal cases, to succumb only after some hours or even days, and then as a result of possibly several contributing conditions not all of which may have been present in the preoperative period. Logically, however, there is a difference between the situation in which the patient actually forfeits his chances of existence on the operating table and is removed thence already doomed, and the patient whose resistance is ample to tide him over the effects of the operative seance as such, but who is unable to weather the storm of the more or less accidental hazards of the early period of convalescence.

The patient who succumbs directly as the result of an operative procedure characteristically belongs to one of four groups: (1) he is the victim of some more or less adventitious abnormality, like status lymphaticus or hemophilia, (2) he is the victim of advanced organic disease, most frequently cardiorenal, (3) he is afflicted with one of a variety of disease syndromes which are more or less easily recognized and are universally known to offer serious operative hazards, such as,

hyperthyroidism, prostatic hypertrophy, intestinal obstruction, craniocerebral injuries, and certain varieties of biliary disease, or (4) the malady which brings him to the operating table is a calamity such that immediate surgery is imperative while at the same time offering little hope of permanent avail.

A. The Hazard of Adventitious Abnormalities: Although the adventitious abnormalities which are capable of causing sudden dissolution during the course of an operative procedure are incompletely known, a most painstaking examination of a patient preoperatively will rarely fail to disclose phenomena suggestive of an impending catastrophe.

The patient afflicted with "emotional imbalance" is frequently a particularly poor operative risk. It may be that in the future much more will be learned concerning this condition, which for the present represents little more than a name, and it is not unlikely that some efficient method of preoperative treatment will eventually be elaborated for its control. Perhaps such control will be made possible by better understanding of the interaction of the glands of internal secretion. For the present the principle of Crile's "anociation" probably offers most with respect to treatment in such cases, and will bear much closer study than is frequently accorded the subject. The use of morphine preoperatively is particularly indicated in such conditions, and this drug may frequently be combined advantageously with scopolamine.

Unduly apprehensive patients usually withstand the effects of operation poorly, and it is not altogether superstition which occasionally prompts the surgeon to delay operative intervention in such cases in the hope that a patient's attitude of pessimism may abate somewhat before the actual surgical ordeal is begun. Unconsciously, perhaps, every successful surgeon uses psychotherapy to some extent, and if a surgical attendant be possessed of any particular gift in this direction he will find few occasions on which to use it to better advantage than in the case of the preoperative patient who is partly or completely convinced that his chances of survival are small.

There should be no excuse nowadays for the inadvertent subjection of a hemophiliac to serious operative procedures. Not only should a carefully taken history suggest the presence of such a condition as hemophilia, but coagulation and bleeding-time reactions are available for detecting any undue tendency toward hemorrhage and should be made routinely, or, as an absolute minimum, whenever explicit questioning of the patient or his relatives discloses a suggestive history.

The possibility of "status lymphaticus" must be remembered in children. The condition is not frequently encountered, but when it is present, even minor operations may eventuate in a very dramatic climax. Greenthal[2] is authority for the statement that 50 per cent of cases occur in children who are victims of congenital defects and deformities. The most reliable direct way of recognizing the condition is by means of the skiagraphic study of the patient and the detection of an area of density in the region of the thymus gland not otherwise explainable. The treatment for such a condition is *x*-ray therapy until the thymic shadow has been reduced to its normal size.

B. THE HAZARD OF ADVANCED ORGANIC DISEASES: Certainly with all the facilities at the command of the modern surgeon no case of advanced organic disease should be allowed to come to the operating table unrecognized. Frequently it is necessary to operate on such persons in spite of an unfavorable general condition and occasionally in emergencies to operate upon them even in the absence of any very formal attempt at ameliorating their condition; but to fail through ignorance to give such patients the benefits of any possible aid would be quite inexcusable.

1. *Chronic Cardiac Disease:* Persons past middle age should always be suspected of being sufferers from cardiorenal disease unless proved otherwise, and when cardiorenal disease is found, a painstaking attempt should be made to evaluate the extent of the disease as well as to ameliorate the patient's condition as much as possible by suitable therapy.

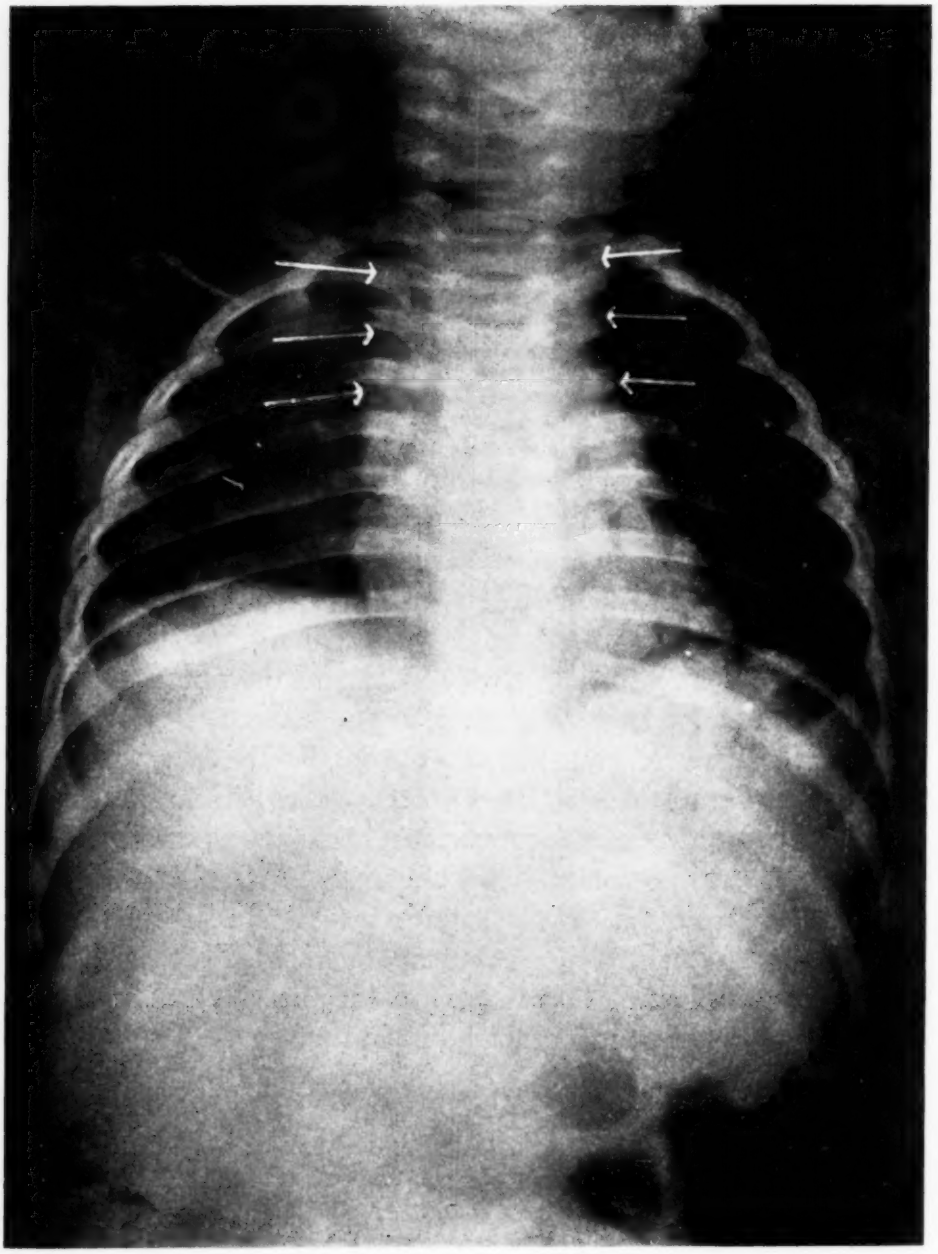

FIG. 1.

FIGS. 1–2. Roentgenograms of two patients with persistent thymic shadows.

Note the triangular or keystone-shaped shadows indicated by the arrows. When patients are treated with suitable deep *x*-ray therapy, the shadow progressively decreases in size until it disappears. Note that the shadow is quite distinct from that cast by the heart and arch of the aorta. (Roentgenograms from Touro Infirmary, New Orleans, La., by courtesy of Dr. Walter F. Henderson.)

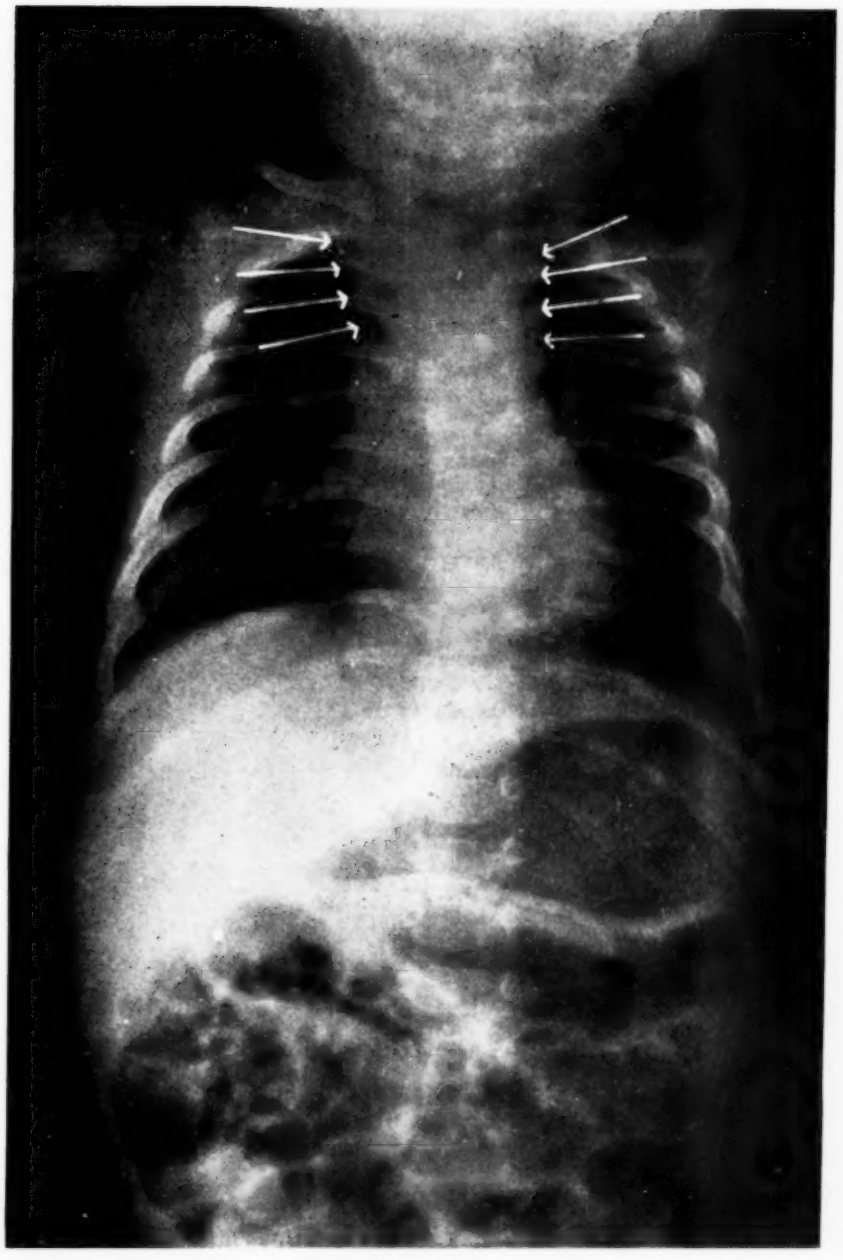

FIG. 2.

As far as cardiorenal disease itself is concerned, one's suspicions should be aroused as to its presence by the blood pressure, by the physical examination of the circulatory system, and by the urinalysis, none of which should ever be omitted in recording the physical findings of any operative case.

When cardiac lesions are suspected additional light can frequently be thrown on the case by the use of the electrocardiograph, or even the polygraph.

Hamilton[3] is authority for the statement that, with the exception of emergency surgery and excluding thyrotoxic patients, about 7.5 per cent of all surgical cases in which a careful history has been taken and an adequate physical examination has been performed will present some symptom or sign suggestive of cardiac disease.

a. Cardiac Neurosis: In a certain rather considerable percentage of patients presenting a history suggestive of cardiac disease, a careful examination of the circulatory system will disclose no signs of serious cardiac damage, and although certain of the individuals belonging to this group are greatly disabled by their symptoms and feel unable to undertake the usual activities of persons in similar circumstances of life, yet under the actual strain of surgical procedures they present no greater operative risk than do normal individuals; they do not develop true heart failure under the stress of surgical procedures. Such patients are commonly classified as victims of "cardiac neurosis" or "neurocirculatory asthenia."

Amongst the symptoms presented by these patients may be mentioned (1) *cardiac pain*, which is especially common and which is usually precordial, but may rarely be substernal or referred to the neck or arm; it bears no constant relationship to exertion; (2) *breathlessness*, which may or may not be associated with exertion or excitement, but which is characteristically associated with some phobia, such as the sensation of breathlessness or smothering when in crowded or closed places; (3) *rapid heart beat*, which may be persistent or may become noticeable only as a result of excitement or exertion, but which

does not present the phenomena of sharp onset and remission, and which is associated with "palpitation," i.e., unpleasant consciousness of the heart beat; and (4) *easily induced fatigue*, which may manifest itself merely as a feeling of weakness or giddiness or occasionally in true syncope.

Inasmuch as such patients present no especial surgical risk, they require no especial preoperative treatment. The only danger in connection with this group of cases is the danger of misdiagnosis, and if a reliable consulting internist be available, patients with essential cardiac disease will not be likely to be wrongly classed with such a group of cases.

b. Extrasystoles: A second group of cases, much smaller than the aforementioned one, consists of individuals who are troubled by the cardiac irregularity known as "extrasystoles." This irregularity may develop only under the strain of exercise, and may occur either frequently or only at long intervals. Such cases as exhibit extrasystoles, provided the true nature of the condition can be determined by electrocardiographic studies, or otherwise, need occasion no particular anxiety, since they withstand the strain of surgical procedures well. Even aggravated cases of true extrasystoles require no special precautions, and never present indications for active stimulation. This particular cardiac irregularity is apt to give the anesthetist and others who watch the patient during the period of anesthesia and of convalescence more cause for anxiety than the condition really warrants.

c. The Potential Cardiac: A third and larger group of cases belongs within a classification which is hard to define. They are the possible or "potential cardiacs." In this group are included patients with varying degrees of systolic murmur and of murmurs of different qualities, and variable location, persistence, pitch, and transmission, and patients with "third" heart sounds. Occasionally some of these patients have slight or doubtful cardiac enlargement. In the event that no more tangible evidence of organic heart disease is found, this class of patients can be regarded as very favorable surgical risks, as far

as their cardiac condition is concerned. Decompensation does not occur as a result of operative procedures, and the patients weather the storm of convalescence without mishap, quite in the absence of all supportive measures.

d. Significant Heart Disease: About 2 per cent of the patients in a general surgical clinic (excluding patients with thyroid disorders) belong, according to Hamilton,[3] to a fourth group, the true cardiacs, or the patients with "significant heart disease."

Among the more important clinical manifestations presented by this group are (1) definite cardiac enlargement, (2) significant disorders of the heart beat, and (3) signs of present decompensation or a history of previous decompensation, i.e., "heart-failure."

All patients belonging within this group must be regarded as presenting a more or less definitely increased surgical risk over patients with normal hearts.

Recognition of cardiac enlargement is largely a matter of careful physical examination by the ordinary methods of palpation and percussion, but in doubtful cases the roentgenogram is of value either in the form of a "6 foot" plate or teleoroentgenography. The electrocardiographic tracing will elucidate the character of most of the significant disorders of the heart-beat, but it commonly fails to demonstrate one of the most important irregularities, viz., "pulsus alternans." The latter phenomenon is customarily appreciated only by noting, during the course of blood-pressure determinations, that alternate arterial pulsations are obstructed at a relatively low pressure, whereas the intermediate pulse beats are lost only at a relatively much higher pressure. The electrocardiogram signally fails to determine, or even to suggest, the source of many cardiac conditions, such as simple tachycardia. The factor of decompensation is of far greater surgical significance than either enlargement of the heart or disorder of the heart-beat, and fortunately for the clinician whose equipment is modest, decompensation is, as a rule, sufficiently easily recog-

nized by the unaided senses. There are, however, no simple, infallible tests by which the cardiac reserve of a patient can be accurately determined, and therefore, it is impossible to determine with accuracy when decompensation is imminent.

Sir James Mackenzie and Orr[4] define heart failure as "that condition in which the heart is unable to maintain an efficient circulation during efforts necessary for the daily life of the individual." So far as the propulsion of blood is concerned the circulation depends upon the integrity of the cardiac musculature, and failure of this musculature to maintain or provide sufficient propulsive force constitutes heart-failure.

Heart-failure occurs in two general types, (1) the "congestive," and (2) the "anginal."

*Congestive decompensation* results whenever the heart becomes unable to propel blood into the large arteries as fast as it accumulates in the large veins. Venous stasis ensues uponsuch failure, and the organs bearing the brunt of the stasis are the liver and the lungs. The liver becomes engorged with blood, tender, and possibly even painful; ascites, or even general edema may ensue. Engorgement of the pulmonary veins may produce breathlessness, râles, cough, and hemoptysis. Congestive failure may, of course, be acute or chronic, mild or severe, fleeting or persistent.

Incidentally, there is a danger, not entirely fanciful, of misinterpreting upper abdominal pain or tenderness due to passive congestion as a surgical condition within the abdomen. Operations on patients suffering from such pain are by no means unknown.

*Anginal decompensation* occurs characteristically only in patients of middle life or those of advancing age. In this type of failure there is underlying disease of the coronary arteries; disease of the coronary arteries by interfering with the intrinsic circulation of the cardiac musculature interferes with the circulation at its source.

The symptoms of anginal heart-failure are entirely subjective at first; the subjective phenomena range all the way

from insignificant discomfort to the agony which can truly be called excruciating (*ex cruce*, crucifixial) and involve a fairly wide, though well defined, anatomical area, notably the precordium, the retrosternum, and the epigastrium. The pain or discomfort may, or may not, radiate; when it does, it extends almost exclusively to the left side, shoulder and axilla, arm, wrist, little finger, and neck, the gums, tongue and jaw, or the scapula.

Physical or mental exertion may precipitate an attack, as may exposure to cold and sleeplessness; the attack may be accompanied by salivation and sweating, and may be followed by profuse urination.

In evaluating the cardiac significance of subjective symptoms, such as those just previously mentioned, the neurological reaction of the patient must be considered, since fairly well defined symptoms in a hypersensitive individual may mean little objectively, whereas the reverse holds equally true. Pressure on the skull behind the ear has been suggested as a means of determining hypersensitivity, this area being relatively insensitive in the normal individual. It should also be noted that symptoms of a given severity do not usually represent equal degrees of cardiac impairment in both males and females; symptoms are to be interpreted somewhat more seriously in the case of males than in the case of females.

The signs of coronary disease are of less significance and reliability; they consist of (1) reduplication of the first apical sound, (2) muffling of the heart sounds at the apex, in the absence of emphysema, and (3) extrasystoles, which are increased by exercise.

Phelps states[5] that all patients presenting the first of these signs, regardless of the symptoms presented, have died within two weeks of any major surgical procedure attempted. He believes that an operation involving as much shock as a cholecystectomy will prove fatal in a male with even mild coronary disease unless means are taken to support the heart, though this may not be true of the female on account of the sex difference noted above.

The patient with coronary disease is, of course, a distinctly unfavorable surgical risk. There is, incidentally, a very real danger of misinterpreting the sudden severe pain of an anginal attack for some surgical catastrophe like acute pancreatitis or ruptured peptic ulcer.

The successful preoperative preparation of the patient with true chronic cardiac disease depends far more upon a prolonged period of rest in bed and the selection of a favorable moment for operation, than upon any specific artificial measures which may be used for the amelioration of the cardiac condition as such. During the preoperative period careful nursing, protection of the patient from sources of mental perturbation, and strict observance of the general principles of hygiene are essential. When contemplating an operation of election on such patients the surgeon should be an opportunist and seize upon a favorable moment for interference; the patient's apparent general condition should be the guiding factor rather than any arbitrary standard of time or convenience.

The value of digitalis in the preoperative preparation of patients with cardiac disease is a somewhat mooted question. There is rather general agreement that this drug is of definite value both preoperatively and postoperatively in the treatment of auricular fibrillation. It invariably slows the cardiac rate appreciably and spares the heart many useless and wasteful impulses.

With regard to the use of this drug in the preoperative treatment of other types of cardiac disturbance there seems to be no consensus of opinion among authorities; some are liberal in their interpretation of the indications for its use, others are inclined to be conservative. In any case, if digitalis is to be used at all it should be used in full therapeutic doses, and such dosage is now fairly definitely established.

The average is as follows: 1.5 gm. of a standardized powdered leaf or its equivalent is required to maintain a maximal effect previously secured, and 1.5 grains for every 10 lb. of body weight during a period of twenty-four hours is required to produce the initial effect.

2. *Chronic Renal Impairment:* The function of urinary excretion is so frequently a decisive factor in the ultimate success or failure of major surgery that specific attention should invariably be paid to it. Fortunately the modern surgeon is in a far better position to detect disturbances of renal function than his forbears, and no surgeon can now be considered to have done his full preoperative duty by a patient if he has not eliminated the possibility of serious renal abnormality on the one hand, or, on the other hand, finding renal impairment present, has not instituted suitable treatment in accordance with the indications furnished by quantitative chemical tests. In ordinary cases of urinary dysfunctions two or more of the following tests should be applied and correlated:

a. The Phenolsulphonephthalein Test: This test was devised by Rowntree and Geraghty and depends upon a calculation of the rate of excretion of a foreign substance by the kidneys. Inherent in the rationale of the test is the assumption that the normal kidney always excretes the paticular substance (phenolsulphonephthalein) at or above a given normal rate, whereas in disease the degree to which the excretion rate is diminished for the foreign substance accurately represents the degree to which the excretion rate is diminished for the normal excretory products of diuresis.

The ability of the kidney to excrete phenolsulphonephthalein does not actually correspond with its ability to excrete the normal substances eliminated by diuresis. Apparently about 50 per cent of the eliminative power of the kidney must be lost before diminution of phenolsulphonephthalein excretion can be detected, and for this reason positive findings have more value than negative ones in the use of this particular test. The test is, however, sensitive enough to detect degrees of renal impairment not accompanied by urea retention, and it is also applicable to the estimation of the function of each kidney separately.

In the actual performance of the test several considerations should receive especial attention:

(1) Twenty minutes or so before receiving phenolsulphonephthalein the patient should be given a sufficient amount of water by mouth (200 to 400 c.c.) to favor active diuresis.

(2) The bladder should be completely empty at the time the dye is injected, or at least should be emptied immediately thereafter.

(3) Exactly 6 mg. of the dye should be injected so that when ampoules of solution are used, an accurate syringe should be used and care should be taken to measure and inject exactly 1 c.c. of the solution, which is of a strength of 6 per cent.

(4) Real accuracy in performing the test cannot be expected in the absence of catheterization of urinary bladder or ureters, as the case may be.

(5) "Appearance time" and rate of excretion vary normally with the method of injection. When injected *intravenously* the following norms are accepted:

(a) Appearance time, four to six minutes.

(b) Amount normally excreted in fifteen minutes, 35 to 40 per cent.

(c) Amount normally excreted in thirty minutes, 50 to 65 per cent.

(d) Amount normally excreted in sixty minutes, 65 to 80 per cent.

When injected intramuscularly the rate of excretion is somewhat less.

(a) Appearance time, ten minutes.

(b) Amount normally excreted in thirty minutes, 30 to 40 per cent.

(c) Amount normally excreted in sixty minutes, 40 to 60 per cent.

(d) Amount normally excreted in two hours, 80 per cent.

b. The Urea Concentration Test: The urea concentration test consists of the following steps:

(1) The patient empties the bladder completely, or it is emptied for him by catheter.

(2) He then drinks a solution of 15 gm. of urea in 100 c.c. of water; this solution may be flavored with *tictura aurantii* if desired.

(3) At the end of one hour and again at the end of two hours the contents of the bladder are evacuated and collected; the amount of urine excreted during each of the two one-hour periods is measured, and the percentage of urea in the second specimen is determined.

If more than 300 c.c. of urine is excreted during the two-hour period an abnormal diuretic effect is attributed to the urea, and the urea concentration value for the second specimen must be interpreted accordingly. A urea value of less than 2 per cent in the second specimen is ordinarily considered as indicating renal impairment and the degree of impairment is considered as directly proportional to the degree of departure from the normal value.

c. Mosenthal's Test: Originally the Mosenthal test involved the use of a special diet, the so-called "high protein diet," but since the essential facts elicited when using such a diet may be about equally well determined in connection with any normal diet, the technique has been subsequently simplified.

The test as commonly performed proceeds as follows:

(1) At 8 A.M. the patient completely empties his bladder and then eats his customary breakfast.

(2) At 1 P.M., or thereabouts, he eats his customary lunch, and about 7 P.M. his usual dinner, but he is allowed neither food nor drink at any time between meals.

(3) Separate collections of urine are made at 10 A.M., 12 noon, and 2, 4, 7, and 10 P.M., and these are properly labeled and set aside for subsequent examination.

(4) At 8 A.M. on the following morning the bladder is again emptied and the contents, together with any urine which may have been passed during the night, are placed in a container labeled "night urine."

(5) The volume and specific gravity of all the various samples are subsequently determined, and the twenty-four hour excretion of sodium chloride and nitrogen is calculated.

The following norms are recognized:

(a) A specific gravity of at least 1.020 must be obtained in one or more specimens.

(b) The extreme variation of specific gravity between specimens must amount to at least 0.009.

(c) The amount of "night urine" must be not greater than 760 c.c., and an amount exceeding 400 c.c. must be regarded with suspicion.

(d) An excretion of more than 5 gm. of sodium chloride in twenty-four hours indicates unnecessary ingestion of this substance.

(e) An excretion of 5 to 6 gm. of nitrogen indicates that sufficient protein is being catabolized to maintain the individual's health and strength.

A "fixation of specific gravity at a high level," i.e., a condition in which the specific gravity of all specimens is 1.020 or thereabouts should excite suspicion of the presence of acute, subacute, or chronic nephritis or passive congestion of the kidney. The possibility of inadequate fluid intake should, of course, be previously excluded.

A "fixation of specific gravity at a low level," a condition known also as "hyposthenuria," is suggestive of a variety of conditions, diabetes insipidus, chronic nephritis, severe anemia, cystitis, pyelitis, polycystic kidney, prostatic hypertrophy, and urethral stricture.

d. Blood Chemistry: The value of blood chemistry examinations in the estimation of kidney damage can scarcely be overemphasized. A sufficient number of estimations of certain of the more obvious chemical constituents of the blood have now been made to establish the normal variations of these substances accurately. When certain of these substances fail to be excreted in normal amounts by the kidney they tend to accumulate in excess in the blood stream, and under such

circumstances a quantitative chemical analysis offers information of great value, since, other things being equal, the magnitude of the excess in the blood stream of these substances over normal may be taken as a direct measure of defective renal excretory function. The substances of particular importance in estimations of kidney function are (1) the so-called "nitrogenous waste products," uric acid, urea, and creatinine, and (2) the blood chlorides.

Since the capacity of the kidney for eliminating one substance is not necessarily accompanied by impairment of its capacity for eliminating others, it is often necessary to make quantitative analysis of more than one constituent of the blood before concluding that no impairment of function exists. This is particularly true in connection with the two fundamental clinical types of chronic nephritis, (a) the "chloride retention" variety, and (b) the "nitrogenous retention" variety. An estimation of the urea content of the blood is of no value in establishing or refuting the occurrence of chloride retention, or is an estimation of the chloride content any criterion of the existence or non-existence of impaired nitrogen excretion.

There is some evidence that in cases showing nitrogen retention uric acid values are a somewhat more sensitive criterion of renal impairment than urea determinations; apparently uric acid retention somewhat precedes urea retention. Because of the relative difficulty of performing uric acid determinations, urea estimations are, however, more frequently performed. Creatinine values rise terminally, and in cases of chronic nephritis by the time clinical increases in this substance are demonstrable the condition of the patient has usually already become critical.

For a more detailed account of the diagnosis of impaired renal function and for the entire discussion of the methods used in treating the various types of impairment the reader is referred to standard texts in internal medicine.

Diabetes is a constitutional disease of sufficient surgical importance to require separate and detailed discussion; there-

fore, for a consideration of this disease the reader is referred to a subsequent chapter.

c. The Hazard of Special Surgical Disease Syndromes: Of the disease syndromes known to offer serious operative hazards much more must be said in later pages; indeed, a considerable part of any treatise on preoperative and postoperative treatment must necessarily consist of a consideration of these conditions. The plan of this presentation provides for separate chapters in discussion of the more important syndromes, and to these chapters the reader will turn in due time.

d. The Hazard of Surgical Calamities: For the last class of patients, those for whom surgery offers a desperate chance, because of the development of some sudden and overwhelming calamity, frequently little can be done by way of preoperative treatment to increase their chances for survival of the operative ordeal. However, a word of general counsel may be offered which may in certain cases prove of the greatest value. To proceed in such cases to operative interference without considering the possible value of such emergency measures as blood transfusion or intravenous infusion would be to court disaster unnecessarily. Frequently, moreover, a preliminary period of treatment for shock may be perfectly feasible and may occasionally save the life of a patient which would otherwise be needlessly sacrificed. In general it is true that there are relatively few operative procedures, aside from the control of massive hemorrhage, in which time cannot be safely taken for a reasonable amount of deliberation in outlining treatment, and the delineation of a plan of procedure such that a subsequent review of the manipulations performed will provide no sources of regret because of oversight due to unwise haste.

## v. The Third General Object of Preoperative Care, or the Prophylaxis of Postoperative Complications

Since the treatment of so many postoperative complications is essentially prophylatic, one of the most essential features in

the preoperative preparations of any patient is the observation and investigation of the case with reference to the possible development of postoperative complications and sequelae. One should ask oneself very frequently during the course of the preoperative observation of any patient what accidents may be expected to occur to this particular patient during the course of convalescence from his anticipated operation.

A major portion of the discussion of the preoperative treatment of postoperative complications can be undertaken most conveniently in connection with a formal discussion of the various complications themselves, and accordingly such discussion is largely reserved for later chapters devoted to postoperative treatment. As certain classes of patients, however, are especially prone to develop particular complications, a short general discussion of this phase of the subject may profitably be interpolated at this point.

A. THE SPECIAL CARE OF INFANTS AND CHILDREN: Infants and children present especial problems in preoperative and postoperative care mainly because of the unstable condition of metabolism in the early years of life.

Children are very likely to lose weight merely as a result of changing their environment from that of the home to that of the hospital, and, accordingly, except in urgent cases there is an especial indication to be in no particular hurry in operating upon a child.

The instability of metabolism in the early years of life manifests itself especially in a tendency to the development of acidosis and a condition akin to uremia, which is characterized by stupor, convulsions, and fever. Apparently both conditions are frequently secondary to dehydration, acidosis depending partly upon failure to excrete acid sodium phosphate properly from a concentrated blood and partly upon improper metabolism of fats, and uremia, or at least a preuremic state, depending upon retention of nitrogenous or other waste products in the blood stream due to improper urinary excretion, again secondary to a condition of increased blood concentration.

It must be remembered that starvation acidosis is particularly prone to occur in the early years of life; the metabolic rate is high, since the ratio between the exposed surface and the weight of the body is high, and also since growth is occurring with rapidity. Under these circumstances when food is withheld rapid inroads are made into the stored fats of the body with the consequent production of a rapidly progressive ketosis.

B. Chronic Alcoholic Surgical Risks: McMechan[6] and others have called attention to the fact that chronic alcoholics are especially subject to untoward complications. In these patients the heart, brain, liver, adrenals, and kidneys are oftentimes the seat of organic changes, and they are usually victims of continuous hypo-oxidation, which is equivalent to saying that they suffer from a persistent form of acidosis. Preoperatively such patients should be provided with large amounts of carbohydrate foods, fruit juices, and alkaline water. Postoperatively they frequently require a transfusion to combat circulatory embarrassment, and intravenous administration of dextrose to combat acidosis, spinal puncture as a means of relieving delirium tremens and alcoholic coma, and full therapeutic doses of some reliable sedative drug.

C. Preoperative Care of the Tuberculous Patient: The development of a so-called "aspiration pneumonia" is the complication most to be dreaded in operations on tuberculous patients. As will be explained in a subsequent chapter devoted to the discussion of postoperative pulmonary infections, the exact mechanism by which "aspiration pneumonia" becomes established is by no means settled, and it is very doubtful whether the mere aspiration of infected material into the pulmonary system, as suggested by the term "aspiration," accounts *per se* for the development of the complication. Whatever the theory accepted as accounting for the development of postoperative pneumonia in tuberculous patients, the presence of infected material in the upper respiratory tract is undoubtedly, at least in part, responsible, and certainly the aspiration of such material plays some very important rôle in the etiology.

Since inhalation anesthesia predisposes to such a development, the use of this form of anesthesia would probably best give way to the employment of some other method whenever possible.

The toilet of the upper respiratory tract is also of the utmost importance in preparing tuberculous patients for operations. Most such patients cough up and expectorate very freely in the morning the secretions which have accumulated during the night; unless scrupulous care is taken, therefore, on the morning of the operation, to sterilize the tract through which these secretions have recently passed an undue amount of risk is taken. Thorough mechanical cleansing of the mouth and throat and the careful use of a suitable antiseptic spray or gargle are undoubtedly of considerable prophylactic value.

In cases in which operations on the chest itself are to be performed, e.g., phrenicotomy and thoracoplasty, immobilization of the unaffected side, particularly in the region of the apex of the lungs, has been suggested as a valuable prophylactic measure. Various forms of adhesive strapping and special forms of apparatus have been devised for this purpose. The patient is also cautioned against deep breathing, and attempts are made to teach the patient to make use of the diaphragmatic type of breathing for a considerable period of time prior to operation.

Against the possible aspiration of vomited material during the course of the anesthesia the best prophylactic measure is probably gastric lavage just prior to the commencement of the anesthesia. In addition to this, the anesthetist should be constantly on the alert during the course of the anesthesia to prevent vomiting and aspiration by skill in the administration of the anesthetic and by manipulation of the patient's posture.

In the event of the development of high temperature after operation this contingency is to be combated, not by the use of depressing antipyretics, but rather by hydrotherapeutic measures, sponging of the extremities with water at a tempera-

ture of 85 to 90°F. or even lower, every two, three, or four hours, as required.

D. The Presence of a Positive Wassermann Reaction in Operative Cases: The presence of a positive Wassermann, Kahn, or other reaction used as an indication of active syphilitic infection cannot be regarded as a contraindication to operative procedures for the relief of acute conditions.

Athough certain surgeons apparently believe that operative wounds do not heal as well in syphilitic patients as in non-syphilitic patients, e.g., Gibbon,[7] Bartlett,[8] Cumston,[9] Senger,[10] Gellhorn,[11] Mondoça,[12] Darnall,[13] and Menninger,[14] there is apparently no good reason for taking the unfavorable influence of lues very seriously except in the case of fractures. Gelle[15] and most authorities on fractures seem to accept syphilis as an important cause of non-union in fractures. Certainly most authors who have written extensively on the subject of post-operative wound healing fail to make a point of the unfavorable influence of syphilis, and such influence is probably generally unrecognized by active surgeons who habitually operate upon classes of patients in whom the incidence of the disease is extremely high, e.g., in the American negro. Darnall,[13] who recognized syphilis as a cause of delayed wound healing was able to cite only 3 cases from an active service of over twenty years, and Goeckerman[16] from a detailed study of the records of 78 cases of syphilis, 28 of which were untreated, concluded that untreated cases only rarely develop postoperative complications in the wound and that treated patients present no greater surgical hazard than non-syphilitic cases. This undoubtedly has been the experience of a large number of surgeons.

Naturally, one does not deliberately operate by choice on patients with any active systemic disease, especially one which yields so readily to therapy as does lues, and it should go without saying that whenever the surgeon has a choice in the matter he should insist that adequate antisyphilitic treatment be provided his patients preoperatively, this being quite as much from the point of view of safety to himself and his

assistants as from that of benefit to the patient, for the inoculation in the surgical amphitheater of physicians and attendants with syphilis is by no means an unknown accident.

E. SELECTING THE ANESTHETIC: In all major surgery, but especially in surgery on the so-called "poor risk" case, the anesthetist and the anesthetic are increasingly being recognized as important factors. An anesthetist cannot do his best work when he is merely called upon to render the patient unconscious while somebody else operates.

The choice of an anesthetic depends upon the nature of the operative procedure proposed and the condition of the patient to be submitted to the ordeal. The whims and fancies of the operator constitute no valid grounds for choice. It seems probable that many postoperative pulmonary complications at least can be avoided by proper selection and skillful administration of anesthetics.

The tendency in this country is more and more toward doing away with the layman anesthetist and the nurse anesthetist and to delegate this most important duty to one thoroughly trained by a considerable period of study, instruction, and research in the specialty of anesthesia. It is only fair that a competent individual should be taken into the confidence of the surgeon and be provided with such information as is in the surgeon's possession for a complete understanding of the condition of the patient to be anesthetized.

The surgeon's attention is ordinarily so completely absorbed by the task in hand, once the operative procedure has begun, that he is in no position to supervise the administration of a general anesthetic, and accordingly he often finds himself more or less at the mercy of the anesthetist during a general anesthesia. Certainly no surgeon can do his best work when his attention is divided between the operative procedure itself and the supervision of the activities of the anesthetist.

Furthermore, the situation in which the surgeon becomes his own anesthetist by adopting spinal, sacral, splanchnic, paravertebral, or other varieties of analgesia is far from ideal in

major surgery since the safety of such methods depends to a very considerable extent upon the early recognition and immediate rational treatment of any complications which may arise, particularly depression in the blood pressure. The safety of the patient urgently demands that if at all possible some competent person besides the surgeon be present at the operating table to assume responsibility for the successful progress of the analgesia, whether this person be actually responsible for its induction or not.

Specific tests purporting to be of value in the direct determination of a patient's ability successfully to withstand the depression incident to the administration of a general anesthetic should be regarded with suspicion. Amongst the best known are the "Sabrasez breath-holding test" and "Moot's rule," both of which are probably of little more than academic interest.

*The Sabrasez Breath-holding Test:* The patient after a short rest is placed in a reclining position. At the end of a normal inspiration the nose is pinched, and the patient is instructed to keep from opening the mouth to breathe for just as long a time as possible. Twenty to thirty seconds is normal, fifteen seconds is indicative of a mild acidosis, five to ten seconds a severe acidosis.

*Moot's Rule:* The pulse pressure is made the numerator and the diastolic pressure the denominator of a common fraction. The range between $^{25}/_{100}$ and $^{75}/_{100}$ is considered normal, patients with values above and below these are considered poor risks.

The same rule stated in slightly different language is as follows: When the pulse pressure divided by the diastolic pressure (PP/DP) is greater than 75 per cent or less than 25 per cent the case is probably inoperable.

F. The Blood Sedimentation Reaction: Although the blood sedimentation reaction is primarily of only diagnostic significance, it is designed to determine the activity of inflammatory processes and therefore, if its value can be proved, may

be of the utmost importance in determining the most favorable time for operative intervention in certain cases as well as the likelihood of development of unfavorable reactions secondary to the activity of certain foci of infection.

The reaction has found particular popularity in connection with the activity of adnexal disease in the female and foci of pulmonary tuberculous infection in both sexes.

1. *Historical Note:* Attempts to correlate with various pathological processes the speed with which a patient's erythrocytes settle in an anti-coagulative column of blood are not new; Galen and much later John Hunter are both given credit for having noted a correlation between the speed of this phenomenon and the presence of disease. The publication of Fahraeus,[17] however, in 1918, of a series of observations on the connection between the sedimentation rate of the blood and pregnancy focussed the attention of many workers on the reaction, and since that time a considerable number of reports have been made on the peculiarities of the reaction as noted in many different abnormal conditions.

2. *Technique of the Test:* Several modifications of technique have been proposed of which only two will be mentioned specifically.

Fahraeus[17] performs his reaction in a glass test tube 17 cm. in length and 9 mm. in internal diameter which is marked to indicate a volume of 10 c.c.; 2 c.c. of 2 per cent sodium citrate solution are first placed in the bottom of the tube, and into this solution blood taken by venepuncture is run to the 10 c.c. mark; the tube is inverted to mix the contents thoroughly, and the height of the column of clear fluid which has formed at the end of one hour is taken as a measure of the sedimentation rate.

The normal value for men is found to be between 2 and 8 mm., and for women from 2 to 10 mm. with an average of 5 or 6 mm.; during menstruation in women the value is much higher, from 10 to 12 mm.

Friedlaender[18] has described at some length a modification of the test. It consists of drawing into a dry 1 c.c. hypodermic

syringe .2 of a cubic centimeter of 5 per cent sodium citrate solution, into which 8 c.c. of the blood to be tested are then quickly drawn. The blood and citrate are now carefully mixed to prevent coagulation, after which the mixture is injected into a specially constructed, dry 1 c.c. sedimentation tube. This tube is 5 cm. in length and upon it are marked the Roman numerals I, II, III, and IV, figures which indicate respectively 6, 12, 18, and 24 mm. The time of sedimentation is noted by observing the interval between the placing of the mixed blood in the tube and the arrival of the meniscus of the sedimenting red blood corpuscles at the observation mark, "Roman numeral IV." In health Friedlaender believes the sedimentation time is from twelve to twenty hours; in latent infection this time is reduced to less than one hour, and in active infection to less than thirty minutes.

3. *Theoretical Considerations:* Various theories have been proposed as to why the erythrocytes sediment faster in some abnormal conditions than in health and other abnormal conditions, but they are all somewhat nebulous. (1) Certain investigators think they have been able to demonstrate a variation between the serum albumin and serum globulin fractions of the blood, those conditions in which the globulin and especially the fibrinogen of the serum are increased constituting examples of increased viscosity and consequent delay in sedimentation time; (2) others believe that the fundamental factor is an increase in the blood lipoids, a consequent decrease in surface tension, and a decrease in electric charges on the erythrocyte; (3) still others attribute the phenomenon to the presence of some specific ferment in the plasma.

4. *Clinical Applications of the Test:* The sedimentation rate of erythrocytes has been proposed as a reliable index of the activity of a variety of inflammatory processes in the body. It has been suggested as an accurate measure of the activity of (1) tuberculous processes, (2) inflammatory adnexal disease in the female, (3) and other more general surgical inflammatory processes even including neoplasia.

In the field of tuberculous disease certain authors have gone on record as believing that the sedimentation time gives a very reliable indication of the activity of processes in the lungs: Morriss,[19] Gardère and Lainé;[20] some authors regard it as of even greater value than the temperature chart: Dreyfus and Hecht,[21] Delhaye,[22] von Tegtmeier;[23] and one author, Cutler[24]: finds it of even greater value than the temperature, pulse, or weight curves.

Pinner, Knowlton, and Kelly,[25] however, contend on the basis of observations on 42 patients, that the sedimentation rate of erythrocytes in tuberculosis is not constant and parallel with the extent and progressiveness of the lesions; the variation in sedimentation rate in normal persons was found to vary widely, and the sedimentation rate was not found to be correlated directly or constantly with either the fibrin or cholesterol content of the blood of tuberculous patients.

In the field of gynecology certain authors regard the sedimentation test as of equal value with the leucocyte count, Noyes and Corverse[26] and Baer and Reis,[27] and others, Rumpf,[28] Pewny,[29] and Falta,[30] regard it as of even greater value than either the leucocyte count or the temperature chart.

In the field of general surgery it has been stated that the test is of value in the diagnosis and prognosis of many surgical conditions, that it frequently proves of value in determining the proper time for the institution of surgical intervention, and that it may be relied upon as an aid in differentiating between benign and malignant newgrowths: Lohr,[31] Gragert,[32] Haller;[33] one author, Rubin,[34] believes it is a more reliable indicator of the condition of the patient than is the temperature chart.

5. *Evaluation of the Sedimentation Test:* The proper evaluation of the test is exceedingly difficult in the absence of much more complete and extensive data than are at present available. The convictions of the more ardent advocates of the method by no means reflect the general consensus of opinion of authorities with respect to its value. Indeed, many have gone

on record as considering the test of little value and have produced statistical evidence to support their contention.

Two definite conclusions seem to have been established: (1) the normal sedimentation index varies within relatively wide limits, and consequently, the boundary line between normality and abnormality cannot be very closely drawn, and (2) the sedimentation reaction is not a specific test for any particular abnormal condition and, therefore, like the leucocyte count, is presumably of value not specifically but as an aid in interpreting the general clinical picture otherwise obtained.

The greatest field of usefulness of the test, as at present understood, is, doubtless, in connection with the activity of tuberculous processes, in which connection it should be considered correlatively with the temperature curve, the pulse rate, and variations in weight. For the present, not too much reliance should be placed on it in any surgical condition except as a relatively minor link in the chain of clinical evidence.

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# Chapter II

# THE PREOPERATIVE TREATMENT OF THE AVERAGE "GOOD RISK" SURGICAL PATIENT

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## Chapter II

# THE PREOPERATIVE TREATMENT OF THE AVERAGE "GOOD RISK" SURGICAL PATIENT

### 1. The Meaning of "Good Risk" as Applied to Surgical Patients

To enter further than has already been attempted into the discussion of the preoperative treatment of cases which require prolonged preliminary courses of treatment would necessitate a virtual résumé of the principles of medical treatment, and such is obviously beyond the scope of the present discussion. The primary concern of the present treatise is, on the other hand, the case which after a reasonable amount of study on the part of the surgeon is deemed suitable to be sent to a hospital for the routine preparations incident upon a relatively immediate operative procedure, and pertains, particularly at present, to the typical case, or the case of moderate severity and one which belongs to the group usually designated as the "good risk" class. "Good risk" cases may be defined as those in which careful examination by all the means at the disposal of the surgical attendant discloses no particular reason for apprehension with regard to the probability of the development of untoward complications during the period of operation and subsequent recovery, and the "typical case" may be considered for present purposes as one of abdominal section for the correction of intra-abdominal abnormalities which in the general run of cases are not attended by a serious mortality, as, for example, simple appendectomy, hysterectomy, cholecystectomy, and the like. Naturally it is not always possible to assure oneself beforehand that any given case belongs in such a classification until after the actual preoperative period of observation under such conditions as prevail in a hospital.

## 11. The Duration of Hospitalization Prior to Operation

Under ideal conditions a patient could be admitted to a hospital and kept there for as long a period of time as might be necessary to establish his clinical status to the complete satisfaction of the medical attendant. Under actual conditions such a state of affairs rarely exists; the patient is usually of only moderate financial means and cannot afford undue delay in the interests of scientific observation as such; his finances are not usually in such a state of inflation as to justify the expense incident to the performance of various tests and maneuvers possibly of interest to the attending surgeon but of no practical value to himself.

Accordingly, one of the questions which the surgeon must ask himself as soon as he contemplates sending a patient to a hospital for preoperative treatment is, "In all probability how much time will such treatment occupy?" The patient is almost sure to request an answer to this question if it is not anticipated by the surgeon.

The answer depends partly upon the facilities which the surgeon has at his disposal for diagnosis and general treatment outside of the hospital and partly upon the particular condition of the patient. It must always be remembered, however, that no matter how carefully an operative case has been prepared outside of an institution, the moment the patient is admitted to such an institution he assumes a relationship to the latter as well as to his consulting surgeon. A hospital cannot hope to the maintain itself without accurate and reliable records of the cases to which it ministers, and one of the surgeon's duties to the institution in which he works, as well as to the patient, the profession of medicine, and society in general, is to insist that a reasonably complete and accurate résumé of the status of a case be made and carefully preserved in writing for purposes of general hospital record. This may involve repetition of some of the effort previously expended on a given case, and may include some duplication of laboratory examinations, but such is unavoidable.

In the average "good risk" case which requires ordinary abdominal section and which stands in no acute need of operative intervention a preoperative period of hospitalization of about thirty-six hours should probably be considered a minimum. Obviously such a statement refers particularly to such cases as have been under the care of the surgeon for some time outside of the hospital, or at least have been seen by the surgeon previously and in whom a diagnosis can be made with reasonable facility and certainty. In hospitals of the charitable or semi-charitable type, which receive patients who have been subjects of little or no study previous to admission, the period of preoperative hospitalization must usually be considerably longer than thirty-six hours, and many patients who have received some previous care, but present special problems, should receive more prolonged preoperative preparation. Patients may, of course, be directed to enter a hospital at any convenient hour either of the day or night, but the later afternoon hours, 2, 3, or 4 o'clock, present certain fairly obvious features of advantage both to the patient and to the institution. As far as the patient is concerned, any last duties which may be required of him can usually best be performed while he is at the peak of efficiency, i.e., during the morning hours, and the afternoon is, therefore, the logical part of the day in which to suspend activities; furthermore, inasmuch as one of the most important indications for treatment of any sick person is rest, and inasmuch as rest is secured especially during the sleeping hours, there is a distinct advantage in vouchsafing the patient an extra night of rest in this manner. There are always a certain number of patients who rest very poorly for a night or two when placed in a strange bed in the midst of unfamiliar surroundings, and such patients commonly derive a very real advantage in being allowed at least one night in which to become accustomed to the new environment, and a second night in which to become more or less thoroughly rested in preparation for the operative ordeal. From the point of view of advantage to the institution a larger executive and nursing staff is

usually in attendance during the day than at night, and this circumstance facilitates the routine of admission and the procedures incident to the assignment of the patient to his room or ward, without at the same time imposing unduly on persons otherwise preoccupied.

The first contact with the hospital should be made as pleasant as possible for the patient, and such a state of affairs can be facilitated by the referring surgeon if he will adopt the simple expedient of preparing the hospital for the reception of the patient either by telephone or, better, by a note addressed to the proper authorities stating briefly the nature of the case and as nearly as possible the exact accommodations desired.

### III. The Reception of a Patient in the Hospital

Attention to the comfort of the patient on admission to a hospital is of importance from two different points of view. In the first place, the reputation of the hospital and of its personnel depends almost entirely upon the impression which it conveys to its patients and their relatives and friends. This is perhaps a comparatively base motive but a very important one, especially in the case of the smaller institution which is not entirely or largely supported by charity. Unfortunately, the first and most impressionable years of the surgeon's life are often spent in a charity institution where, rightly or wrongly, the attitude toward the patient is mostly impersonal. The patient loses his identity as a sick person and becomes "case number so and so" or "bed number so and so." Under these conditions there is every inducement to disregard the psychology of the sick patient and to give him the impression that the institution exists for the welfare of anybody but himself. Patients convalescing from an illness spent in an institution of this type occasionally entertain any but flattering opinions of the latter and not infrequently contribute their mite to a reputation which militates against the whole-hearted support of the institution by the community. Incidentally, the surgeon

who assumes the attitude just described is apt to do more harm to himself than he does either to the institution or the patient, because such an attitude is fatal to a certain highly desirable personal esteem which, more often than not, is the keynote to success in the practice of medicine.

The other consideration is the humanitarian one which demands that the sick person, whatever his rank or station in life, be accorded every opportunity to recover his health with all possible speed.

Of course it is not always possible to receive patients immediately upon their application for admission and from that moment give them undivided attention, but the importance of habits of promptness should be impressed on all persons connected with the admission of patients, and delays in assigning them to beds and of disposing of them in accordance with such assignments are to be deplored. Orderliness and a business-like deportment, with despatch in execution of details, are much more important in this regard than any attempt at sympathy, which latter might be misconstrued and in most cases would be unappreciated, though this statement must not be considered as relieving attendants of the necessity for being thoughtful, civil, and considerate.

The sick patient is usually apprehensive and observant to a degree scarcely appreciated by any of his professional attendants. The early attendance of the surgeon to whom the case is assigned, prompt history taking and physical examination, unless such is contraindicated for some good and sufficient reason, and the early leaving of necessary instructions and orders relieves the nervous tension of a patient as nothing else can. From the point of view of the medical attendant, also, there is nothing to be gained by delay; promptness and alertness are qualities to be pursued by him as assiduously as application to study, observation, and thoroughness in a purely professional way.

When emergency cases are admitted to a surgical service promptness on the part of the medical attendant becomes a

matter of necessity rather than of expediency. The loss of any considerable amount of time in the appreciation of a condition of shock by a medical attendant may cost the patient his life; the same applies to a case of hemorrhage. Simple fractures may be converted into compound ones during a delay, and the smoldering clothing of a burned patient may go unnoticed; acid and alkali burns may develop in the interim, and patients may develop respiratory complications if left in draughty areaways for considerable periods of time; unconscious patients may do themselves either active harm in inflicting injuries upon themselves, or passive harm in the development of palsies due to faulty posture.

### IV. Preoperative Personal Hygiene of the Patient

In his zeal to give the patient the full benefit of a thorough medical survey as outlined in a previous chapter, a duty which becomes an insistent obligation in case a patient is scheduled for early operation, the surgeon should not neglect the supervision of certain of the more intimate details associated with the patient's personal hygiene, usually falling more strictly within the sphere of nursing care.

The matter of bodily cleanliness is one of especial importance. On the afternoon of admission and previous to being put to bed, the patient should be given a warm bath with plenty of soap and water and should be encouraged to scrub himself thoroughly, especially the creases of his body, and to dry himself carefully with a rough towel, thus loosening and removing the outer cornified layers of the epithelium of his skin together with their contaminating bacteria. If he is to remain two nights in the hospital prior to operation the bath is repeated on the second night, though this time scrubbing need not be particularly encouraged, the main desideratum being an abundance of soap and warm water and subsequent thorough drying.

Oral hygiene should be made a matter of especial attention. The removal of infected teeth or tonsils may be performed

only provided that sufficient time can be allowed prior to operation for the complete local healing of the tissues subsequent to such manipulations. Thorough brushing of the teeth should be encouraged after each meal and especially on the morning of operation. In cases in which oral hygiene is especially poor a mouth wash or gargle may be of considerable value both on the days immediately preceding the operation and on the morning of the operation just before the patient goes to the operating amphitheater.

Male patients should be encouraged to shave regularly during the period of preoperative preparation, and they should be required to shave carefully on the morning of the operation before going to the operating amphitheater.

### V. The Preoperative Care of the Bowels

A. Preoperative Starvation: The practice of withholding food for twelve to eighteen hours prior to the performance of abdominal operations, formerly in vogue, has, according to present conceptions, little to recommend and much to condemn it. Emptiness of the gut is not essential or even desirable in cases in which the lumen of the intestinal tract is to be invaded. On the one hand, surgical technique is such as to control the escape of intestinal contents into the general abdominal cavity, and on the other, a collapsed and contracted state of the intestine (a) makes anastomosis unduly difficult of performance, (b) and favors postoperative stenosis of the opening.

B. Food and Feeding: The prescription of sterilized foods prior to operations on the stomach and upper intestine is theoretically desirable, but usually unnecessary, because, in the first place, the oral cavity through which these foods must pass is itself never sterile, and, in the second place, stomach contents and the chyme in the duodenum and upper jejunum are normally sterile, at least to all intents and purposes. Furthermore, and much more important in connection with preoperative starvation, there is always a tendency to the production of starvation acidosis; this is at least a mild danger in

all cases, but it is particularly a danger in children and in other patients in whom previous morbidity has upset metabolism.

Patients may ordinarily be allowed to eat such articles of diet as are provided in the regular hospital dietary or such food as their particular inclinations may dictate up to the evening meal preceding the day of operation. This meal must be easily digestible, consisting possibly of soup, boiled fish or chicken, spinach, butter, toast, and jelly. Potatoes, cheese, strong tea and coffee, fried foods, and the like are interdicted; no limit, however, need necessarily be placed on the amount of approved foods eaten. Later in the evening if the patient is inclined to be restless and cannot sleep, hot milk, or some other hot drink, may usually be given.

No food is ordinarily allowed on the morning of operation, but water may be freely taken up to an hour or so preceding the journey to the operating room; a cup of hot tea or coffee, sweetened but without cream, may be substituted in case the patient does not relish plain water.

c. Castor Oil and Other Purgatives: Attention should be paid to the action of the bowels for several days preoperatively. Usually the administration of purgatives or laxatives is not indicated, but liquid petrolatum is preferred as a laxative, if any laxative be needed at all, because its action is purely that of a mechanical lubricant, and its use therefore entails no undesirable or unknown side actions of a pharmacological nature.

Castor oil has been widely used in past years as the purgative of choice for use in the preparation of a patient for operative procedures. The action of this drug is well known; in the duodenum it is transformed into ricinoleic acid which is a powerful intestinal irritant, so powerful that it causes reddening and swelling of the intestinal mucosa and stimulates the muscular coats of the intestine to active contraction, with a resultant relatively complete evacuation of the contents of the intestine.

Granted that intestinal evacuation is desirable in preoperative treatment, a proposition which is by no means univer-

sally accepted, there are, however, two important side effects of such a violent cathartic as castor oil, both of which presumably are undesirable: (1) the irritated condition in which the coils of intestine find themselves after the catharsis, and (2) the inertia of the intestines which invariably follows a period of hypermotility. Mitchell[1] believes the latter to be one of the most fruitful sources of postoperative ileus. In addition to these disadvantages, there is another which is also of importance, viz., the disturbance of the patient's rest, both locally and generally, especially important if purgation is undertaken in the hours just preceding operative intervention.

Castor oil has been mentioned specifically as an undesirable preoperative drug because of the favor it formerly enjoyed, but it is only one of a large group of cathartic drugs which may be employed to the patient's detriment by the uninstructed or careless attendant. Active catharsis is almost invariably best omitted entirely from the preoperative program, but provided that it is to be employed, at least forty-eight hours should subsequently be allowed before operation, in order to give the intestine sufficient time in which to recover from the trauma inflicted. Mechanical cleansing of the lower bowel with enemata some hours before the time set for operation will ordinarily be all that is required as far as the specific care of the intestine, itself, is concerned.

D. The Use of Enemata: An enema may be given if desired in the evening preceding the day of operation; if administered, it should be given relatively early to avoid disturbing the patient's rest unnecessarily.

On the morning of operation the lower bowel should always be emptied by enema unless some contraindication exists, and this not less than one and one half hours before the time set for operation. If an enema be given subsequent to this time absorption of any fluid inadvertently left within the bowel may be incomplete and the patient's bowels may move on the operating table, an embarrassing and highly undesirable occurrence. In cases of emergency operation neither enemata

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nor any other form of intestinal preparation should ordinarily be used.

### VI. The Routine Use of Digitalis

Operative procedures by their very nature tend to decrease blood pressure, and as the success of surgical manipulations depends to a considerable extent upon the avoidance of excess depressions, any measure would seem to be of value which might be used to stabilize cardiac action.

Miller[2] and Polak[3] have shown that even apart from the occurrence of shock there is a postoperative decrease in blood pressure of approximately 14.2 mm. of mercury. In postoperative shock, of course, the blood pressure falls much lower still. Apart from the immediate untoward effect of such depressions of blood pressure a variety of postoperative complications are believed to be caused, or at least favored, by vascular insufficiency, hypostatic pneumonia, pulmonary edema, embolism, and thrombosis. The maintenance of normal blood pressure relationships in connection with surgical procedures is, therefore, of great importance.

As has been previously mentioned, in the use of digitalis for purposes of regulating the diseased heart in surgery the usual principles observed in connection with the use of this drug in medical cases are respected. Rapid or slow digitalization may be used depending upon the preferences of the individual medical attendant or in accordance with the exigencies of the particular case, and maintenance doses are regulated with the object in view of obtaining the maximal therapeutic effect of the drug while at the same time avoiding undue toxic action.

The technique of full therapeutic digitalis administration need not be detailed here, as it is discussed very fully in most treatises on the practice of medicine.

The prophylactic administration of digitalis in full therapeutic doses to patients with essentially normal hearts is quite another matter. It has been asserted at various times that digitalis acts beneficially on the normal heart. Thus Geist and

Goldberger[4] believe that digitalization of the normal heart is effective in maintaining postoperative blood pressure, and to this extent prevents the development of circulatory failure. These authors used the slow method of digitalization in their investigations and observed electrocardiographic tracings, as well as the pulse and blood pressure. The normal pulse rate was uninfluenced in normal cases. The average postoperative decrease in blood pressure was only 3 mm. of mercury during the first twelve hours, after which the tension gradually returned to normal.

Other investigations, however, have failed to corroborate these findings. Marvin and others[5] have shown that complete digitalization of the normal heart before operation does not influence the postoperative blood pressure, pulse pressure, or general outcome at all.

In the absence of more convincing evidence than has been presented to date one is almost forced to conclude that in the case of the heart which shows little or no evidence of cardiac failure the exhibition of digitalis probably improves the patient little or none at all. Notwithstanding this, some authors have gone on record as favoring the routine use of *small doses* of digitalis for purposes of "fortifying the normal heart," no attempt being made to obtain full therapeutic effects.

If the use of the drug in full doses is of no value in patients with normal hearts, the use of small doses must be considered quite irrational since Eggleston and others[6] have seemingly shown that digitalis bodies have a negligible effect unless they reach a relatively high concentration, i.e., 1 to 1.5 c.c. of the tincture per 10 lb. of body weight, and apparently the equivalent of 1 c.c. of the tincture is excreted daily even in cases which show congestive heart failure. Accordingly, smaller doses than these would seem to be contraindicated even in cases presenting definite indications for the use of the drug.

Apparently the promiscuous use of preoperative digitalization is not without positive danger; Maynard[7] has reported a case of digitalis intoxication thus produced.

## VII. The Use of Narcotics and Atropine

The use of drugs of the hypnotic group preliminary to the induction of general anesthesia has one or more of the following objects in view: (1) to prevent psychic shock, (2) to prevent the development of postoperative lesions in the lungs, (3) to modify or abolish struggling and discomfort during the administration of the anesthetic, and (4) to increase the margin of safety of the anesthetic.

Perhaps the most important function of the preliminary administration of a narcotic is the quieting of the fears and apprehensions of the patient, i.e., the prevention of psychic shock. Probably this indication does not appeal to the average surgeon as strongly as it should, because the surgeon himself, by virtue of his experience, self-confidence, and familiarity with his surroundings, is able very inadequately, and then only as a result of some considerable mental effort, to appreciate the thoughts and feelings of his patient to whom such an ordeal as a surgical operation is the event perhaps of a lifetime, every sight, smell, and sound in the hospital serving to intensify the forebodings of pain and perhaps dissolution. The experience of being led to the gallows or the electric chair could hardly excite more terror for the surgeon than the experience of being taken to the operating room excites in many of his patients; it is by no means uncommon on questioning a patient prior to some operative procedure, which is actually rather trivial, to find that the patient firmly expects not to come through the ordeal alive. Furthermore, unless one has recently experienced the sensations incident to the taking of a general anesthetic at the hands of a none too skillful anesthetist one is hardly in a position to know how actually dreadful this experience can be. It is little wonder that cases are on record in which patients have died merely as a result of fear of such an ordeal.

When Simpson was, for the first time, about to try chloroform on a patient, the orderly who was carrying the bottle fell and spilled it; no other being obtainable, Simpson proceeded without anesthesia with the operation, which was for hernia. The patient died at the first incision.

Later, another patient to be operated upon demanded chloroform; his condition being low, the surgeon feared to grant his wish, but a cloth was held over his face; he took four inhalations of air and died. A third instance is that of a French surgeon, Desault, who drew his finger-nail over the perineum to mark the line of incision, when the patient suddenly gave a cry and died.[2]

Today the fear of operative procedures would be much less likely to result in outright death of patients than formerly, since the popular mind has become better educated in the matter of operative hazards, and the factor of pain has been largely eliminated by the modern methods of anesthesia. However, the only humane, as well as scientific, procedure is to administer opiates in sufficient quantities prior to any operation thoroughly to quiet the patient's apprehensions, unless, indeed, such a procedure is contraindicated for good and sufficient reasons. Doses of morphine of ⅙ grain or less never do this, in the case of the average adult individual weighing 120 lb. according to Gwathmey[9]; not infrequently a single dose of ¼ grain does not suffice; if one uses such doses, there is almost invariably an increase of systolic blood-pressure of 10 to 40 mm. of mercury and occasionally of twice this value, just before the commencement of the anesthesia, showing that the psychic factor has not been sufficiently combated. Gwathmey[9] urges that preceding the administration of any kind of anesthesia for major operative procedures such preliminary medication should be administered as to render the patient indifferent to his surroundings; this applies to local, general, or spinal anesthesia with equal force. When ample preliminary medication has been provided, the stage of excitement is either not noticeable or entirely absent; cyanosis, sweating, and hyperpnea are not prominent, and no increase in blood pressure or change in the character of the respiration should be noted.

Using 7 per cent of ether intravenously, Gwathmey has been able to demonstrate experimentally in animals that (1) anesthesia is induced sooner, (2) less ether is used, and (3) the margin between complete anesthesia and respiratory failure is

widened, when preliminary narcotization has been properly induced.

Using albino rats in two series of cases Gwathmey has shown that distention, edema, and congestion of the lungs, and occasionally, minor or massive atelectases occur in animals etherized without preliminary narcosis, whereas such lesions do not occur in cases in which preliminary morphine (and magnesium sulphate) is used (500 animals). Morphine either alone or in combination with atropine probably sufficiently meets the indications in most cases, but with this view not all authorities agree.

Gwathmey believes that synergistic medication, using a combination of magnesium sulphate and morphine, best meets the indications. Doses of 2 c.c. of a 50 per cent solution of magnesium sulphate have been injected in over 20,000 cases at the Lying-In Hospital of New York, with the production of a negligible number of sloughs (about 7 cases). In favor of combining magnesium sulphate with morphine, Gwathmey cites two parallel series of 200 cases each. In one series morphine alone was used, in the other a combination of morphine and magnesium sulphate; in the first series of cases a postoperative sedative was required, on an average, four hours after operation, in the second series, not for sixteen hours.

Gwathmey advocates the hypodermic use of morphine sulphate, $\frac{1}{8}$ grain, dissolved in 2 c.c. of a 50 per cent solution of magnesium sulphate, to be repeated once or twice, according to conditions, at intervals of twenty to thirty minutes. This represents about $\frac{1}{100}$ of the lethal dose of magnesium sulphate.

Glass and Wallace[10] also advocate a combination of morphine with magnesium sulphate. They believe that the morphine lessens the incidence of intestinal paresis, acidosis, nausea, and vomiting, bronchial and renal irritation, and that the combination with magnesium sulphate usually prevents the necessity of giving additional doses postoperatively.

Smythe[11] and Harmon[12] endorse the method of Gwathmey's synergism warmly.

The preference of Gwathmey and his followers for a combination of magnesium sulphate and morphine, and his contention that these drugs act in a synergistic manner, has been rather seriously criticized.

Von Issekutz[13] thinks that the synergism between morphine and magnesium sulphate is negligible, and Beckman[14] and Sims[15] are also in accord with this opinion. These authors believe that the effect of magnesium salts is additive and not synergistic, and that, therefore, the addition of such salts to morphine is incapable of prolonging the action of the latter drug.

Neuwirth and Wallace[16] have been able to demonstrate that symptoms of the depressant action of magnesium salts occur in the dog only when the serum magnesium content reaches 5 mg. or more per 100 c.c., and that such a concentration is produced only as the result of relatively large subcutaneous injections, 0.25 gm. of magnesium sulphate per kilogram of body weight. Profound narcosis results only after the serum content has been raised to 20 mg. or more per 100 c.c., and this occurs only after the injection of 2.7 gm. of magnesium sulphate per kilogram of body weight. The content of magnesium required for the production of a narcotic action could not be reached when magnesium sulphate or lactate in aqueous solution was given by stomach or by rectum, and two or three injections of 2 c.c. each of a 50 per cent solution of magnesium sulphate failed to raise the serum content much above 3 mg. per 100 c.c. of serum. Such contentions seem to cast some doubt upon the advantages of so-called "synergistic" narcotization, but, of course, do not alter the indications for narcotization by other methods.

With regard to the combination of atropine with morphine little need be said. The combination seems fundamentally rational as (a) the atropine tends to counteract the irritant action of anesthetic vapors, especially ether, on the mucous membranes of the upper respiratory tract, and thus to prevent excess secretion of mucus and saliva, and (b) it is a sort of pharmacological antidote for morphine, many of its actions

being essentially antagonistic to those of morphine. The practice of habitually ordering atropine in conjunction with morphine is, however, apt occasionally to lead one into trouble, because patients exhibit idiosyncrasies for atropine more frequently than for any other drug, and the action of atropine on the heart may prove very alarming in patients with an initial tachycardia.

A combination of morphine with scopolamine would be almost ideal were it not for the idiosyncrasies for the latter drug sometimes manifested by patients; scopolamine, as is well known, in addition to being an excellent narcotic is also an excellent antimenmonic, patients rarely remembering at a later date much that has occurred during the period of action of the drug.

All in all, however, because of the remarkable toxicity of scopolamine in certain cases and its tendency to produce delirium and maniacal states, it is unsuitable for routine use; to this almost all surgeons seem to be agreed, although some authorities regard the contraindications more seriously than others, whereas many surgeons use this combination occasionally in accordance with special indications.

Special indications for the use of scopolamine are usually considered to exist in connection with operative procedures to be performed under local, regional, or spinal analgesia, and the indications are reinforced by apprehensiveness on the part of the patient and by suggestions of inability or disinclination to cooperate.

Bartlett and an increasing number of other authorities feel that some of the newer derivatives of barbituric acid can be made to take the place of morphine or of morphine and scopolamine as a preoperative medication with very material benefit to the patient. Bartlett especially has made a systematic attempt to determine which of these preparations is safest and best, and as a result of careful observations on more than 1100 patients during a period of nine years has decided in favor of luminal. He favors luminal partly on account of the fact that

it has been in use longer than some of the other compounds and accordingly has been an object to clinical assay for a relatively long period of time, and partly because it is a relatively safe drug as evidenced by the fact that there has not appeared in the literature a "single authenticated death from the use of luminal alone (though single doses of 50 grains have been reported twice)." Bartlett[17] recommends a dose of from 14 to 30 grains, routinely about 15 grains, administered about three hours before the operation is expected to begin; the drug takes effect in about an hour and the effect lasts from twelve to twenty-four hours, sometimes much longer. Such doses of luminal produce a sort of "semi-anesthesia" during which the patient is oblivious to his surroundings, but can be roused momentarily to answer questions or to take water or medicinal agents by mouth; the important cough and "gag" reflexes are not abolished. Furthermore, when the effect of the drug has worn away, the patient remembers little or nothing of the events that transpired during its period of action.

The objection to the use of the barbituric acid derivatives, however, like the objection to the use of scopolamine, is its proneness to show idiosyncrasies. The barbituric acid derivatives occasionally, instead of narcotizing patients, excite them and make them delirious, maniacal, garrulous, and difficult to control.

Sodium amytal, one of the newest of the barbituric acid compounds, is not free from such action; the case of a professional colleague is still fresh in the mind of the author: This very amiable and excellent surgeon required a rectal operation, and having been very favorably impressed with his observations on the action of sodium amytal in his own practice decided to have the drug used in his own case. He received the drug by mouth and within about an hour, he stated subsequently, his memory for all subsequent events connected with the operative seance and the early postoperative period became blank. He talked rationally while going to the operating table, cooperated with the operating room attendants in assuming

the proper position on the table, and appeared quite in possession of his mental faculties when he was subsequently placed in bed. He was much surprised, however, to learn much later that soon after being left alone in bed he became maniacal, rose from bed, disported himself about in an unclothed condition with great hilarity and shouted lustily about his local sensations in a very frank and not altogether elegant manner. He was restrained with difficulty, and had his operation been of a different variety might have done himself much harm.

### VIII. Last Minute Preparations

Just before sending the patient to the operating room there are two or three minor matters which require attention.

1. The patient's hair should be confined by a close-fitting cap or head-dress, the latter being fashioned from a towel or a piece of gauze. In females, if the hair be long, it should be neatly and carefully braided and wound about the head under the head-dress. All hair pins and combs should be carefully removed.

2. Detachable false teeth, either plates or bridges, should be removed from the mouth of the patient. Other artificial appliances should, of course, also be removed when possible unless other factors contraindicate the procedure.

3. The patient should be required to empty the urinary bladder thoroughly, and if any doubt exists as to his ability or inclination to do this, he should be catheterized. If, for any reason the bladder has not been emptied a notation to that effect should be made in writing by the attending nurse and should be appended to the chart in a conspicuous place.

4. On leaving for the operating room the patient should wear a loose fitting garment which hangs entirely from the shoulders and which can easily be adjusted to expose the area to be operated upon, usually a hospital gown made of white muslin, reaching to the ankles and tied together with tapes at the back. He should be provided with warm slippers and a dressing-gown if ambulatory, and in any case should be

warmly wrapped in blankets especially in cold or inclement weather.

### IX. The Preoperative Skin Preparation of Patients

Formerly it was the preoperative custom to give the skin of any proposed operative area a much more rigorous preparation than is considered necessary or desirable at the present time. On the day preceding the operation the operative area was thoroughly shaved and then scrubbed with a bristle brush and warm soapy water; this was followed by several rinsings of sterile water and the application of a compress rung out of antiseptic solution, commonly bichloride of mercury or potassium permanganate. Just prior to the operation the antiseptic compress was removed, the area was again scrubbed and rinsed, and was further treated with alcohol and ether.

Even with such relatively vigorous preparation the percentage of local infections was discouragingly high, mainly, as is now believed, because during the course of these manipulations the skin received undue trauma. Tissues scraped by the razor blade, scratched by the bristle brush, and then macerated by hours of contact with an antiseptic compress were so devitalized that a suitable nidus of infection was readily established in connection with the added trauma caused by the surgeon's knife.

It is probably quite impossible according to the most efficient methods ever devised to sterilize the skin absolutely. Were the problem merely one of devitalizing the bacteria on a flat epithelial surface, perfect sterilization might indeed be accomplished; but the skin is a complex and irregular structure pierced by innumerable openings leading deeply into its substance, even more deeply into the subcutaneous tissues, and at times penetrating, as in the case of occasional coil glands, to the underlying muscular layers. The sweat glands and the hair and sebaceous follicles are of small caliber and of relatively great depth. Being exposed to contamination from the surface they contain bacteria. Being secretory structures,

however, they contain secretion either in liquid, semi-solid, or solid form. The contained secretion, both theoretically and clinically, serves as an excellent medium for keeping any previously imprisoned bacteria in and the antiseptic out. Since it is probably impossible to effect complete sterilization of such a complex tissue, even though sterility is highly desirable, it becomes necessary to adopt an expedient, viz., that of disinfecting the skin as completely as possible without, at the same time, devitalizing it to such an extent as to impair its natural capacity for dealing with such organisms as will inevitably survive the process.

The best compromise developed up to the present time consists of two parts: (a) the preliminary preparation, which is made usually on the evening preceding the day set for operation, and (b) the final preparation, which is made on the operating table after the patient has been anesthetized and just prior to the commencement of the operation itself.

The preliminary preparation consists of lathering the skin of the operative area well with a good quality of shaving soap, shaving with a sharp razor, washing gently with tap water, swabbing with alcohol, and drying by simple exposure to the air. The area may or may not then be covered with a dry sterile dressing, depending upon circumstances and one's individual preferences.

Such a dressing may prevent gross contamination of the area in certain cases, but patients of limited intelligence cannot be expected to resist the temptation to contaminate themselves with their fingers. Furthermore, especially in warm weather, even a comparatively light dressing may become saturated with perspiration, a circumstance which would make any dressing highly undesirable. All in all, the advantages and disadvantages of the dressing are perhaps equally divided and in view of this, many careful and successful surgeons prefer no dressing at all.

In those cases in which operative procedures must follow directly upon the preliminary skin preparation, water should

be avoided, and dry shaving should be the rule, since antiseptics penetrate moist tissues very imperfectly. Those which are relatively insoluble in water naturally do not penetrate moist tissues well and water soluble drugs become rapidly diluted by water contained in the tissues and thus rapidly lose their efficiency.

Final skin preparation consists of swabbing the operative area with a good fat solvent and subsequently painting it with a suitable antiseptic solution. In applying the fat solvent the mistake is often made of proceeding as if the mere application of the substance were the desired end. That this is not so is, of course, self-evident, for the purpose of the fat solvent is the removal of fat and not merely its redistribution. Consequently, in making use of the solvent sufficient absorbent material should be used in the form of a swab or "wipe" to remove the dissolved fat as completely as possible, and the surface of the absorbent material should therefore be frequently readjusted or turned so that the dissolved fat may be actually lifted away from the surface of the skin, and not merely distributed thereupon. Alcohol is a less efficient fat solvent than certain other substances, particularly since it contains some water, and furthermore, being frequently incorporated as an ingredient in the actual antiseptic solution subsequently used, is not particularly desirable as an additional preliminary application. However, in those cases in which for one reason or another the skin surface undergoing preparation is already moist, a preliminary swabbing with alcohol is of value because of its dehydrating action. The two fat solvents commonly used are ether and benzene, both of which are mildly irritating, though to nothing like the same extent as certain other fat solvents, like xylol, which, because of their markedly irritating properties, are quite unsuitable for use on the skin. The irritating properties of the common fat solvents, especially of benzol, must be remembered, and complete evaporation from the skin must be allowed to occur before draping of the area is attempted if disconcerting inflammatory processes are to be avoided.

Ether, of course, evaporates so rapidly that "burns" are not likely to occur in connection with the use of this substance.

Although a host of substances have been devised for final skin disinfection, perhaps there are still no better general skin antiseptics than iodine and picric acid, both in the United States Pharmacopeia. Tincture of iodine in full strength and a 5 per cent solution of picric acid in alcohol (kalmerid) are relatively inexpensive, are non-proprietary, and are almost always at hand or are very easily obtainable. Most other preparations are open to one or more of the following objections:

1. Their value is unproved.
2. They are unduly expensive for routine use.
3. They are under the stigma of unwise exploitation.
4. They stain linen and render it unsightly for subsequent use.
5. They are not easily procurable and compoundable.
6. They are not universally applicable.

Preoperative skin sterilization is a very serious matter and one which should not be made a subject of experiment by the surgeon who is unable to check his results bacteriologically and to assemble a sufficiently large series of cases to make his investigation of real scientific value to himself and of general value to the profession of surgery at large. When skin sterilization is in point, the promiscuous adoption of various new drugs as they make their appearance on the market, and the capricious trial of various combinations of drugs, which may be advocated from time to time in scientific journals, is neither safe for the patient nor rational for the surgeon.

Mercurochrome has gained considerable favor in recent years as a skin disinfectant, but its value is questionable. There is a rather general agreement at present that it is not efficient *per se*, i.e., in aqueous solution.

Simmons[18] found that 2 per cent aqueous mercurochrome solution failed to kill Staphylococcus aureus in ten minutes, killed B. coli in one minute, killed Streptococcus pyogenes in two and one-half minutes, and did not kill Streptococcus scar-

latinae "Dick 1" in five minutes. Aqueous alcohol-acetone 2 per cent mercurochrome solution killed these organisms in one minute, but so did also an alcohol-acetone-aqueous control; a 3.5 per cent tincture of iodine was effective in destroying these organisms also within one minute. Anthrax spores were killed by 7 per cent tincture of iodine in one hour, but by 3.5 per cent tincture of iodine only in from four to ten hours, and not within ten hours by the other solutions. Simmons concludes that a 3.5 per cent alcoholic solution of iodine is superior to any preparation of mercurochrome as a bactericide for use on the unbroken skin, that the aqueous solution of mercurochrome is too feebly bactericidal to be used at all, and that the alcohol-acetone preparation is a comparatively feeble bactericide compared with the United States Pharmacopeia tincture of iodine.

Scott, Hill, and Ellis[19] believe on the basis of experimental study that there are extreme experimental conditions under which neither a 7 per cent tincture of iodine nor a 2 per cent solution of alcohol-acetone aqueous mercurochrome will sterilize the skin, and that a simple 2 per cent aqueous solution of mercurochrome is unsafe for use on human skin because of its too feeble bactericidal power. They conclude, however, that both 7 per cent tincture of iodine and alcohol-acetone aqueous 2 per cent mercurochrome are satisfactory routine antiseptics for skin preparation.

In the technique of skin sterilization certain specific considerations of a mechanical nature would seem to be of sufficient importance to merit brief mention:

1. When planning the extent of the area to be sterilized one should be careful not to err on the side of conservatism. Even the most astute and skilful surgeon occasionally has to incise the skin somewhat beyond the limits which he at first considers sufficient, and although no surgeon could legitimately object to the delay and inconvenience incident to the sterilization of some additional skin area at a considerable distance from the original site of operation made necessary by some unforseen

circumstance requiring a second incision, the original skin preparation must be deemed faulty if provision has not been made for free extensions of the original incision in all directions and even secondary incisions or counter-incisions in adjacent areas. Taking the case of the abdominal operation as an example, and specifically the removal of an appendix, skin sterilization should be sufficiently extensive so that the original incision may be made long enough to provide for a hysterectomy or a secondary incision for the removal of a gall bladder, or a stab-wound for colostomy in the opposite flank, without approaching dangerously near to an unsterilized area. In this connection it must not be forgotten that when sterile drapings are in position on a patient the confines of the sterilized area are not apparent, and the danger of inadvertently encroaching upon unprepared skin in the extension of an incision is not at all imaginary. Ordinarily when the abdomen is to be opened for any purpose no less than the entire skin area bounded by the costal margin cephalad, the symphysis pubis caudad, and a line drawn perpendicularly through the anterior superior spine of the ilium on either side will be sufficient to meet the ordinary emergencies of this type of surgery. In preparing patients for laparotomies all the hair should be removed from the pubic region as a matter of routine.

2. When one is actually engaged in skin sterilization especial attention should be paid to all areas in which the skin is furrowed or thrown into folds; such areas as the umbilicus, the groin, especially in obese patients, the intermammary groove and the inframammary fold in women and the gluteal cleft are illustrative. Care should be taken to insure removal of fat and sebaceous material primarily, and the complete penetration of all such areas with antiseptic solution, secondarily.

3. In applying antiseptics to the skin area with a swab, as is usually done, the part of the skin first treated should be the proposed line of incision; the remaining area should be covered by sweeping the swab in concentric circles from the proposed site of incision outward, never returning to the center of the

area unless absolutely necessary and then only with a fresh swab. As the swab passes over the surface of the skin its antiseptic content is diminished and it also picks up bacteria; only the more susceptible of these are killed really quickly, and if the contaminated swab is repeatedly passed over the proposed line of incision, permanent contamination with very resistant organisms may occur. *Per contra*, the fresh swab not only is itself sterile, but it is saturated with antiseptic solution of undiminished strength.

4. In order to avoid the production of iodine burns, when using tincture of iodine as a skin disinfectant, the primary application of the drug may be followed in several minutes by a secondary mopping with alcohol to remove part of the iodine originally applied; but even this is inefficient provided that the skin area be draped with sterile linen while yet moist. The most important factor in the prophylaxis of iodine burns is complete evaporation of the readily volatile part of the drug prior to the draping.

## X. General Remarks and Conclusions

In modern surgery the preoperative care of average good risk surgical patients is rather conservative, as will be noted from a consideration of the foregoing discussion. The change in technique from radical purgation, prolonged starvation, and the exhibition of stimulating drugs to a regime of physiological rest unatteneded by much actual therapeutic manipulation has been adopted largely as a result of a better appreciation of the causes of postoperative complications and the irresistible argument furnished by the generally smooth and uneventful convalescence of that great class of patients subjected to emergency surgery in which formal preoperative treatment according to previous notions had been impossible. The preoperative preparation of the present illustrates particularly well the principle that in the absence of definite indications for therapy no therapy should be attempted.

There are, needless to say, in the case of many surgical patients very definite indications for active preoperative therapy which have not previously been discussed; for the most part, such patients, however, present special problems which remove them from the class of ordinary "good risk" cases, and special methods for dealing with these problems can best be discussed subsequently in connection with the specific methods themselves. Consequently the preoperative care of surgical patients as considered in this monograph by no means ends at this point.

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